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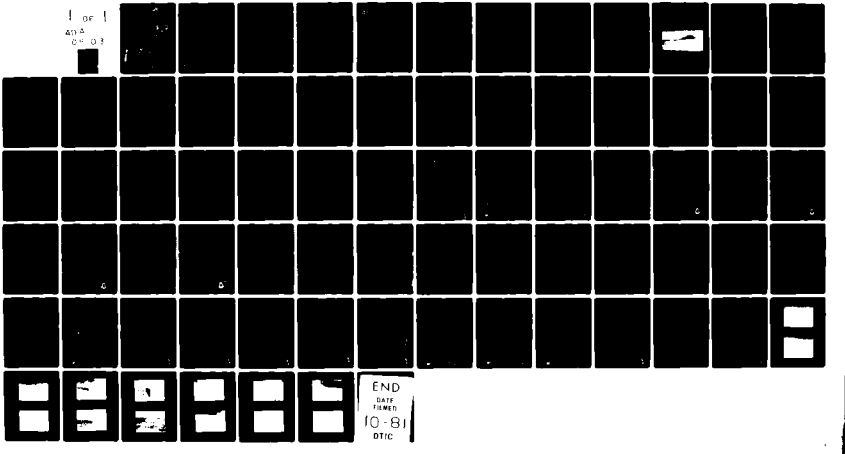

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VERDIGRIS-NEOSHO RIVER BASIN

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LOST CREEK WATERSHED STRUCTURE D-1
NEWTON COUNTY, MISSOURI
MO. 20731

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
FOR: STATE OF MISSOURI

APRIL, 1981

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	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Crawford, Murphy & Tilly, Inc. Russell /Clairmont Robert /Andrews Edward /LaBelle	8. CONTRACT OR GRANT NUMBER(s) DACW43-81-C-0010
9. PERF U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Lost Creek Watershed Structure D-1 Phase I Inspection Report
Newton County, Missouri
Missouri Inventory No. 20731

This report presents the results of field inspection and evaluation of the Lost Creek Watershed Structure D-1 (MO 20731).

It was prepared under the National Program of Inspection of Non-Federal Dams. This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division

30 JUN 1981
Date

APPROVED BY: SIGNED
Colonel, CE, Commanding

2 JUL 1981
Date

VERDIGRIS-NEOSHO RIVER BASIN

LOST CREEK WATERSHED STRUCTURE D-1
NEWTON COUNTY, MISSOURI
MISSOURI INVENTORY NO. 20731

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared By

Crawford, Murphy & Tilly, Inc., Springfield, Illinois
A & H Engineering Corporation, Carbondale, Illinois

Under Direction Of

St. Louis District, Corps of Engineers

For

Governor of Missouri

APRIL, 1981

PREFACE

This report is prepared under guidance contained in Department of the Army, Office of the Chief of Engineers, Recommended Guidelines For Safety Inspection Of Dams, for a Phase I investigation. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigation, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. Additional data or data furnished containing incorrect information could alter the findings of this report.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

PHASE I INSPECTION REPORT
NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

Name of Dam:	Lost Creek Watershed Structure D-1
State Located:	Missouri
Inventory Number:	20731
County Located:	Newton County
Stream:	McDougle Creek
Date of Inspection:	14 January 1981

BRIEF ASSESSMENT:

Lost Creek Watershed Structure D-1 was inspected by a team of engineers from Crawford, Murphy & Tilly, Inc. of Springfield, Illinois and A & H Engineering Corporation of Carbondale, Illinois. The purpose of this inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Lost Creek Watershed Structure D-1 is an earthfill embankment completed in 1980 across McDougle Creek. The dam is owned and operated by the Newton County Soil and Water Conservation District and is located on private property. The facilities are used for flood control.

Based on the guidelines, the St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification, which means that loss of life could occur if the dam fails. The estimated damage zone extends approximately four miles downstream of the dam. Located within this zone are four homes, outbuildings and Missouri Route Y. The dam is in the small size classification due to its height of 34.7 feet and maximum storage capacity of 697 acre-feet. Under the guidelines classification, a small size dam has a height greater than 25 feet but less than 40 feet and/or a maximum storage capacity greater than 50 acre-feet but less than 1000 acre-feet.

Our inspection and hydrologic and hydraulic analyses indicate that the spillway capacity of the dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The dam will hold and pass approximately 34 percent of the Probable Maximum Flood (PMF) without overtopping. The Probable Maximum Flood is defined as the flood that may be expected from the most severe combination of critical

meteorologic and hydrologic conditions that are reasonably possible in the region. The guidelines require that a dam of small size with a high downstream hazard potential pass 50 percent to 100 percent of the PMF. For the purposes of this report, the Spillway Design Flood was selected to be 50 percent of the PMF due to the limited downstream flood hazard potential. The 1 percent probability flood (100-year frequency flood) will not overtop the dam. The 1 percent probability flood is one that has a 1 percent chance of being equalled or exceeded in any given year.

The overall condition of the dam appeared to be good although some deficiencies were noted during the inspection. There is thin vegetal cover on much of the upstream and downstream face of the dam and there are numerous small gullies and wash areas. The riprap around the principal spillway intake structure is on a very steep slope and could slide during wave action.

It is recommended that the owners take the necessary action without undue delay to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.

Russell Clairmont, P.E.
Crawford, Murphy & Tilly, Inc.

Robert Andrews, P.E.
A & H Engineering Corporation

Edward LaBelle, E.I.T.
Crawford, Murphy & Tilly, Inc.

PHOTOGRAPH 1. OVERVIEW OF LOST CREEK WATERSHED STRUCTURE D-1.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LOST CREEK WATERSHED STRUCTURE D-1
MISSOURI INVENTORY NO. 20731

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

A. Authority:

The National Dam Safety Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Lost Creek Watershed Structure D-1 located in Newton County, Missouri.

B. Purpose of Inspection:

The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and a visual inspection in order to determine if the dam poses hazards to human life or property.

C. Evaluation Criteria:

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, Recommended Guidelines for Safety Inspection of Dams. These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations and private engineers.

1.2 DESCRIPTION OF PROJECT:

A. Description of Dam and Appurtenances:

Lost Creek Watershed Structure D-1 is an earthfill structure approximately 34.7 feet high and 745 feet long at the crest. The dam has a drop inlet principal spillway with a drawdown device, and an emergency spillway which is a trapezoidal channel cut into natural ground at the right abutment. In this report right and left orientation are based on looking in the downstream direction.

B. Location:

The dam is located in Newton County, Missouri, on McDougle Creek. The longitude of the dam is 94° 31.2' West and the latitude is 36° 49.2' North. The dam is located in Section 17 and Section 18 Township 24 North, Range 33 West which is within the Seneca, Missouri-Oklahoma 7.5 minute quadrangle map. Included in Appendix A are a location map for the dam on Plate 1 and a vicinity map on Plate 2.

C. Size Classification:

Lost Creek Watershed Structure D-1 has an embankment height of approximately 34.7 feet and a maximum storage capacity of approximately 697 acre-feet. Therefore the dam is in the small size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has classified this dam as a potential high hazard dam. The estimated damage zone extends approximately four miles downstream of the dam. Located within this zone are four homes, several outbuildings and Missouri Route Y. The affected items within the damage zone were verified by the inspection team.

E. Ownership:

The dam is owned and maintained by the Newton County Soil and Water Conservation District, Route 6, Box 28A, Neosho, Missouri 64850. The dam and watershed are located on private property.

F. Purpose of Dam:

The dam was constructed for flood control purposes.

G. Design and Construction History:

Lost Creek Watershed Structure D-1 was designed by U. S. Department of Agriculture, Soil Conservation Service. Soils reports and as-built plans are available from the Soil Conservation Service office in Columbia, Missouri. Construction of the dam and appurtenances was completed in August, 1980. The contractor on the project was Fred Beachner. No modifications to the dam are known to have been made.

H. Normal Operating Procedures:

Operating equipment at Lost Creek Watershed Structure D-1 includes an adjustable slide gate on the principal spillway structure to drain the lake. Maintenance of the dam is the responsibility of the Newton County Water and Soil Conservation District. Due to the fact that the dam was recently constructed and has never impounded any water, no maintenance of the operating equipment has been required to date.

1.3 PERTINENT DATA:

A. Drainage Area (Acres):	1044
B. Discharge at Damsite (CFS):	
Maximum known flood at damsite	not known
Drawdown facility capacity at maximum pool	21

Principal spillway capacity at maximum pool	63
Emergency spillway capacity at maximum pool	1806
Total spillway capacity at maximum pool	1874

C. Elevation (Ft. Above MSL):

Top of dam	1088.8
Streambed at downstream toe of dam	1054.1
Normal pool	Fluctuates with evaporation, rainfall and seepage
Spillway crest	1065.5
Pool elevation during inspection 1/14/81	No water impounded by dam
Apparent high water mark	None found
Maximum tailwater	Not known

D. Reservoir Lengths (Feet):

At top of dam	2900
At spillway crest	1300
At emergency spillway crest	1800

E. Storage Capacities (Acre-Feet):

At top of dam	697
At spillway crest	53
At emergency spillway crest	460
At pool level during inspection 1/14/81	Not applicable
At elevation of apparent high water mark	Not applicable

F. Reservoir Surface Areas (Acres):

At top of dam	48.6
At spillway crest	9.2

At emergency spillway crest		37.0
At pool level during inspection 1/14/81		Not applicable
At elevation of apparent high water mark		Not applicable

G. Dam:

Type		Rolled earth
Length of crest (feet)		745
Height (feet)		34.7
Top width (feet)		14
Side slopes (Horiz.:Vert.)	Upstream (above & below berm - see cross section of dam on sheet 3 of 18)	2.5:1
	Downstream	2.5:1
Zoning		2 zones as shown on sheet 3 of 18 of Appendix A
Impervious core		Impervious clay zone in center of dam
Cutoff		12' wide core trench to bedrock
Grout curtain		None known

H. Diversion and Regulating Tunnel: None known

I. Spillway:

I.1 Principal Spillway:

Location	Near center of the dam
Type	Concrete drop inlet with 208 ft. of 24" R.C.P. through dam
Crest elevation (feet above MSL)	1065.5
Effective length of weir (feet)	12
Other	12" slide gate for drawdown

I.2 Emergency Spillway:

Location	Immediately right of the right abutment
Type	Excavated trapezoidal grass-lined earth channel
Bottom width at crest	40 feet
Channel U/S of control section	Length not well-defined; 22% slope
Control section	Approx. 168' long 0% slope
Channel D/S of control section	Approx. 150' long 8.3% slope
Side slopes	Approx. 3:1

J. Regulating Outlets:

Location	On principal spillway inlet structure
Type	12" square opening with slide gate
Crest elevation	1057.72
Access to closure	At top of principal spillway inlet structure

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

Information concerning the design of the dam was obtained from SCS offices in Columbia, Missouri. The project was initially conceived as part of the Lost Creek Watershed Protection and Flood Prevention Project by the SCS. Geologic investigations, a soils report and stability analyses were prepared in 1976 and 1977 by the SCS. Hydrologic and hydraulic design as well as the construction drawings, were prepared in 1976-1978 also by the SCS in cooperation with the Soil and Water Conservation District of Newton County, Lost Creek Watershed Subdistrict, Newton County Court and the City of Seneca.

A copy of the as-built drawings was obtained from the State SCS office in Columbia, Missouri. The drawings include hydrologic and hydraulic design data as well as the logs of soil borings in the emergency spillway, in the borrow area upstream of the dam and in the natural ground along the centerines of the dam and principal spillway. Also available was a summary of soils investigations and stability analyses performed by the SCS.

2.2 CONSTRUCTION:

Information concerning the construction of the dam was obtained from SCS offices in Columbia, Missouri, and the Newton County Soil and Water Conservation District, Neosho, Missouri. The dam was constructed in 1979-1980 by Fred Beachner. Materials testing and full-time construction inspection were performed by SCS.

According to as-built drawings, a core trench with a bottom width of 12 feet and side slopes of 1H to 1V was excavated to sound limestone along the entire length of the embankment and across the emergency spillway to the adjacent hillside. During construction of the core trench in the area of the emergency spillway a crevice in the bedrock formation was encountered and filled with a high slump concrete (class 4000). Details of this change from the original plans can be found in the as-built drawings.

The fill material for the dam was placed in 2 zones according to as-built drawings. Zone 1, consisting of the more plastic fine grained soil materials at the borrow source, were placed in the center of the dam to elevation 1083.9 with a top width of 10 feet and side slopes of 0.5H to 1V. Zone 2, consisting of the coarser grained gravels with the least fines were placed in the exterior of the fill.

Records of materials testing and construction inspection were not available, but according to SCS, they are stored in the national archives. Selected sheets of the as-built construction drawings are reproduced in Appendix A.

2.3 OPERATION:

The only operating facility at the dam is a 12" x 12" slide gate located on the principal spillway structure which regulates the drawdown of the lake.

2.4 EVALUATION:

A. Availability:

Design reports and as-built plans for the project are available and include a geologic study, slope stability analysis, and hydrologic and hydraulic information.

B. Adequacy:

The information presented in the reports and on the as-built plans, in combination with the field survey and visual inspection, is considered adequate to support the conclusions of this report.

C. Validity:

The original design of the structure and appurtenant works appears valid. The soil sample taken during the field inspection and the hydrologic analysis made of the structure for this report, closely correspond with information found in the original design analysis.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

A. General:

The field inspection was made on 14 January 1981. The inspection team consisted of personnel from Crawford, Murphy & Tilly, Inc. of Springfield, Illinois, and from A & H Engineering Corporation of Carbondale, Illinois. The members were:

Russell Clairmont, P.E. - Crawford, Murphy & Tilly, Inc.
Robert Andrews, P.E. - A & H Engineering Corporation
Edward LaBelle, E.I.T. - Crawford, Murphy & Tilly, Inc.

The field inspection included the determination of dimensions and elevations of the dam and appurtenances to verify dimensions and elevations found on the as-built drawings available for the dam. For this report all elevations were obtained by using a benchmark from the as-built plans. The benchmark is designated as No. 1 and is a bronze plate set in concrete at station 0+00 of the original centerline of the dam. The elevation of the benchmark is 1102.73 feet. A visual inspection of the dam, spillway, drainage area, and downstream channel was performed and photographs were taken of each of them.

No one accompanied the inspection team during the inspection. Mr. Warren George, the District Conservationist for the local SCS Field Office, supplied information concerning the dam prior to the inspection trip.

Maps and general drawings of the dam and appurtenances are presented on Plates 1 through 3 and on the as-built drawings included in Appendix A and a hydrologic and hydraulic analysis is presented in Appendix B. Photographs of the dam and appurtenances are presented in Appendix C.

B. Regional and Project Geology:

The major structural features in Missouri consist of the Ozark uplift, subsequent basins and numerous glacial features including the major river systems (Mississippi and Missouri).

The general subsurface geology in Newton County consists of Precambrian overlain by Paleozoic formations. The Mesozoic Era is locally absent through most of this area and the Cenozoic Era is represented usually in surface deposits.

The Paleozoic rock formations encountered in the subsurface in Newton County consist of Cambrian, Ordovician, Silurian-Devonian, and Mississippian aged rocks. The structural attitude of these Paleozoic rocks is controlled principally by the shape of the Ozark uplift. The apex of this uplift is

centered in the St. Francois Mountains of southeast Missouri and the Arkoma basin dips away from the apex through Southern Missouri. The boundary between the Devonian and Mississippian aged formations in Missouri is not firmly established. However, all four major series of the Mississippian system are represented in Newton County. (Kinderhookian, Osagean, Meramecian, and Chesterian).

The probable extent of all four major glacial periods stopped far short of Newton County. However, these deposits of loess are found in some areas of the county (the probable limit of loess deposits occurs along the southern boundary of Newton County).

The soil cover at the dam site consists of a 1 to 4 foot layer of loess. The Cenozoic loess deposits are usually comprised of Illinoian (Loveland) loess or the Wisconsinan (Peoria or Bignell) loess. The underlying soils were exposed on the slopes of the discharge channel and consist of a cherty residium. These deposits are comprised of a slightly gravelly silt (ML), gravelly to very gravelly silty clay (CL to GM) and a cherty red clay (CL). The thickness of this deposit ranges from 6 to 24 feet.

Bedrock outcrops were not observed during our field inspection. However, the subsurface exploration performed by the Soil Conservation Service encountered a cherty limestone bedrock below the cherty residium. The cherty limestone is believed to be the Warsaw formation of the Meramecian series of the Mississippian system. This formation is a very fossiliferous limestone, with chert as beds and nodules.

The dam site is located in Seismic Zone 1 as shown on the Seismic Zone Map in the inspection guidelines.

C. Dam:

Lost Creek Watershed Structure D-1 is a zoned earthfill dam with a height of approximately 34.7 feet and a length at the crest of approximately 745 feet. The principal spillway includes a drop-inlet type intake structure, a 24 inch diameter conduit through the dam, and a plunge pool. The emergency spillway consists of a trapezoidal channel cut into natural ground just right of the right abutment. There is a riprap berm around the spillway intake structure for wave erosion protection and there are abutment drains in both abutments.

Measurements made during the field inspection generally agree with those shown on the as-built drawings. Elevations at the site were checked by using a benchmark from the as-built drawings. All elevations taken during the inspection were approximately 0.5 feet lower than those shown on the as-built drawings. The discrepancy between these different elevations was not determined, but for this report, those elevations obtained during the field inspection were used.

Both the vertical and horizontal alignment of the crest of the dam appeared fairly uniform. The crest has a thin stand of grass cover which was planted in August 1980.

The horizontal alignment of the crest is straight from the right abutment to approximately the mid-point of the embankment where it curves upstream to the left abutment. According to the preliminary engineer's report, this curved alignment was choosen to avoid the voids and honeycomb porosity encountered on the left abutment of the original alignment. The crest has a width of approximately 14 feet. The elevation of the centerline of the crest of the dam varies from 1088.8 to 1089.2. The profile of the crest of the dam is shown on Exhibit 3 of Appendix B.

The upstream face of the dam has a slope of 2.5 horizontal to 1 vertical above the 10 foot wide berm and a slope of 2.5 horizontal to 1 vertical below the berm. The downstream face of the dam has a slope of 2.5 horizontal to 1 vertical with no berm. Measurements during the field inspection indicated the dam slopes varied in the range of 2.5 horizontal to 1 vertical, to 2.7 horizontal to 1 vertical. Both the upstream and downstream face of the dam have a thin vegative cover of grass. A typical cross section of the dam can be seen on Sheet 3 of 18 of Appendix A.

Surface erosion of the embankment has occurred in isolated areas on both the upstream and downstream slopes of the dam and along both abutments due to the thin grass cover. Most surface erosion extends to a depth of 3 to 4 inches with some gullies along the abutments 6 to 12 inches deep. According to the owner, the dam was completed during the summer of 1980 and had not had a chance to establish good ground cover prior to the inspection trip. Photograph 5 shows a close-up view of the eroded areas along the downstream face of the dam. No sloughing has occurred on the upstream or downstream slopes. No surface cracks or unusual movement or cracking at or beyond the toe of the dam was noticed. No evidence was found of animal holes or burrows on the embankment. There was no apparent evidence of seepage from the dam. During the inspection, there was no water impounded by the dam and according to the owners, this has been the situation since construction.

According to the plans, there are rock fill gutter drains along both downstream abutments. These drains outlet into riprap berms near the toe of the dam at the right and left abutment. There were no signs of seepage from either rock filled drain. Sheet 5 of 18 of Appendix A shows the location of the drains. Photographs 6 and 7 show close-up views of the outlet riprap berms at the right and left abutments.

A shallow soil sample was obtained from the embankment near the center of the dam on the downstream slope. The sample was classified as a light brown silty clay with sand and gravel (CL).

D. Appurtenant Structures:

D.1 Principal Spillway:

The principal spillway is located near the center of the dam and consists of a drop-inlet type intake structure and a conduit through the dam. The rectangular concrete intake structure has 10" thick walls and inside dimensions of 2 feet by 6 feet by 12 feet high from the top of the structure to the invert. There are two high stage rounded overflow weirs located on either side of the structure with a total effective length of 12 feet and an elevation of 1065.5. The high stage overflow is protected from the entrance of large debris by structural aluminum alloy trash rack bars spaced 1'-3" apart. The spillway inlet structure also includes a 12" low stage discharge opening set at an elevation of 1057.72 or 1'-3" above the invert of the structure. Flow through the low stage or drawdown opening is controlled by a manually operated slide gate. The intake structure appeared to be in excellent condition because no major settlement, cracking or deterioration of the concrete was noted. At the time of the inspection, there was no water in or around the structure. In order to protect the embankment around the intake structure from wave action there is a riprap berm constructed in the area. The upstream face of the riprap was on a steep slope of approximately 1 horizontal to 1 vertical and could slide during wave action. The intake structure can be seen in Photographs 8 and 12.

The outlet conduit through the dam consists of 208 feet of 24" diameter reinforced concrete pipe set on a slope of approximately 1% according to the plans. There are four anti-seep collars around the conduit which are 24 feet apart beginning 66 feet from the intake structure. The end section at the discharge end of the conduit is cantilevered over the stilling pool and discharges into an excavated riprap lined stilling pool just beyond the toe of the dam. The horizontal alignment of the outlet conduit was uniform as viewed from the downstream end. The conduit appeared to have a slight vertical camber as called for in the plans and was in good condition with no signs of seepage or deterioration.

The stilling pool into which the pipe discharges is approximately 35 feet long and is riprap lined. There was no evidence of erosion or sloughing of the riprap basin. Photograph 9 shows a view of the outlet conduit and stilling basin.

D.2 Emergency Spillway:

The emergency spillway is a trapezoidal channel excavated in natural ground right of the right abutment. The crest is a grass lined level channel 168 feet long and 40 feet wide at an elevation of 1083.4 feet. Side slopes of the spillway are on a slope of 3H:1V. The short approach channel has a 22.0 percent slope. The discharge channel has an average slope of 8.3 percent and is approximately 150 feet long from the end of the crest to the flood plain of the downstream channel. The left bank of the discharge

channel is an earthfill berm with 3H:1V side slopes. The berm is intended to direct emergency spillway flow away from the downstream toe of the dam. Plan and profile views of the emergency spillway are provided on Sheet 3 of 18 of Appendix A and Exhibit 4 of Appendix B. A cross section of the emergency spillway is shown on Exhibit 5 of Appendix A. The emergency spillway is also shown in Photographs 1, 10 and 11.

The emergency spillway generally has a thin but adequate stand of grass. Erosion was noted upstream of the spillway crest and at the downstream end of the discharge channel.

E. Reservoir and Watershed:

The reservoir area for Lost Creek Watershed Structure D-1 was dry at the time of the inspection with the exception of a small pond in the area of the borrow pit as shown in Photograph 12. According to Mr. Warren George of the Newton County Soil and Water Conservation District, the dam was built to contain flood water and would remain dry most of the time. The watershed for the dam contains the proposed flood storage area, open grassland and some heavily forested areas. Approximately 20% of the watershed and flood storage area is heavily forested terrain with the remaining area consisting of open area ranging from short grass to tall prairie grass. Slopes throughout the watershed range from 3% to 7%. A typical view of the watershed is given in Photographs 12 and 13.

About 75% of the watershed has soil belonging to the Clarksville-Nixa Association and 25% belonging to the Tonti-Nixa Association. Both soils groups are in hydrologic Group B as defined by SCS. Sedimentation of the reservoir has not yet occurred.

F. Downstream Channel:

The channel just downstream of the spillway discharge channel is a trapezoidal ditch with some brush and trees approximately 200 feet downstream of the plunge pool. Slopes of the channel, referred to as McDougle Creek, are generally very flat. The flood plain is wide and clear below the dam with the exception of a few trees. Approximately 1000 feet downstream of the dam, McDougle Creek crosses under Missouri Route Y. Photographs 14 and 15 show the downstream channel and flood plain.

3.2 EVALUATION:

A number of deficiencies exist which should be corrected. These items include thin grass cover and erosion gullies on the upstream and downstream slopes of the dam and on the downstream channel and approach area of the emergency spillway. A better vegetal cover should be started after the erosion gullies have been repaired.

The riprap protection around the principal spillway structure is on a very steep slope (1:1) and the riprap could be dislodged by wave action. Remedial action to improve this situation would include flattening the slopes of the riprap.

The capacity of the spillways should be increased as discussed in Section 5.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

The operating equipment at Lost Creek Watershed Structure D-1 consists of an adjustable slide gate mounted on the principal spillway outlet structure which controls flow through the 12" diameter drawdown pipe. The pool level of the reservoir is controlled by rainfall, runoff, evaporation, capacity and operation of the drawdown facilities and the capacity of the uncontrolled concrete inlet structure.

4.2 MAINTENANCE OF DAM:

Maintenance of the dam is the responsibility of the Newton County Soil and Water Conservation District. Information obtained from Mr. Warren George of the District indicates that no maintenance program has been set up at this time at Lost Creek Watershed Structure D-1 due to the fact that the dam was just completed in August 1980. It is a normal procedure for the Newton County Soil and Water Conservation District and SCS to inspect the dams controlled by the District every spring.

4.3 MAINTENANCE OF OPERATING FACILITIES:

The maintenance of the operating facilities of the dam is the responsibility of the Newton County Soil and Water Conservation District. No maintenance has been required on the facilities since they were built in August 1980.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

No warning system is known to exist.

4.5 EVALUATION:

A maintenance program for the dam and operating facilities should be set up in the near future. Erosion gullies on the dam should be repaired and reseeded.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. Design Data:

Information on hydraulic and hydrologic design data is available in the as-built drawings for Lost Creek Watershed Structure D-1 which were obtained from the State SCS office in Columbia, Missouri. The information includes watershed data; reservoir elevation-area-capacity relations; principal and emergency spillway design data; and freeboard hydrograph information.

The significant dimensions of the dam and reservoir were measured or surveyed during the inspection and compared with those found in the as-built drawings and from available topographic mapping. The maps used in the analysis are the 7.5 minute U.S. Geological Survey quadrangle sheets for Seneca, Missouri-Oklahoma and Neosho West, Missouri. Soil information is available from a report from SCS completed during design of the dam.

B. Experience Data:

No recorded rainfall, runoff, discharge, or reservoir stage data were available for the lake and watershed. Information received from the Newton County Soil and Water Conservation District indicated that there has never been outflow from the lake through the spillway since completion in August 1980.

C. Visual Observations:

A description of the watershed and reservoir is given in Paragraph 3.1E and a description of the spillways is given in Paragraphs 3.1D1 and 3.1D2. The lake level has apparently been controlled in the past by rainfall, runoff, evaporation, and seepage of the lake water into the ground. During the inspection trip a small amount of water was stored in the original borrow area as seen in Photograph 12.

A description of the downstream channel is given in Paragraph 3.1F. The downstream hazard zone extends approximately 4 miles downstream from the dam and includes 4 homes, outbuildings and Missouri Route Y.

D. Overtopping Potential:

Based on the hydrologic and hydraulic analysis presented in Appendix B, the dam and spillway have the capacity to store and pass approximately 34% of the Probable Maximum Flood (PMF) without being overtopped. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region. The recommended guidelines from

the Department of the Army, Office of the Chief of Engineers, require that this dam, which is in the small size category with a high downstram hazard potential classification, pass 50% to 100% of the PMF without overtopping. For the purposes of this report, the Spillway Design Flood was selected to be 50% of the PMF due to the limited downstream flood hazard potential. Thus the spillway capacity of this dam is considered inadequate. The dam and spillway will hold and pass a 1% probability (100-year frequency) flood without overtopping the dam.

Data for the 34%, 50% and 100% PMF are presented in the table below:

Percent PMF	Starting Pool Elevation (MSL)	Peak Inflow To Lake (cfs)	Maximum Pool Elevation (MSL)	Maximum Depth Over Dam (feet)	Peak Discharge (cfs)	Overtopping Duration (hour)
34%	1065.50	4070	1088.76	0	1843	0
50%	1065.50	5985	1090.09	1.29	5405	2.60
100%	1065.50	11970	1091.22	2.42	11476	5.40

The starting pool elevations shown were found by assuming the lake level was at the principal spillway crest elevation and then applying an appropriate antecedent storm to the watershed 4 days prior to the storm being analyzed. The antecedent storm for the analysis of the PMF ratio storms is a storm half the magnitude of the storm being analyzed.

All of the inflow to the lake from the antecedent storms passes through the spillways and therefore results in a starting elevation at the principal spillway crest for the analysis of the 34%, 50% and 100% PMF.

Lost Creek Watershed Structure D-1 will be overtopped by flood flows of less magnitude than the Spillway Design Flood. Overtopping of the dam could cause serious erosion and lead to failure of the structure. Flood discharges resulting in overtopping and failure of the dam could be expected to produce substantial stage rises in the hazard zone. Overtopping would lead to potential loss of life and potential damage to property.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. Visual Observations:

Observed features which could adversely affect the structural stability of this dam are discussed in Section 3 of this inspection report.

B. Design and Construction Data:

There is on file with the U.S. Department of Agriculture, Soil Conservation Service a summary report of soils recommendations and a slope stability analysis that was prepared for the design of this dam. There is also on file as-built plans which include geologic cross sections data of the stream channel, borrow area, and centerline of dam.

The slope stability analysis includes analysis of the upstream slope under drawdown conditions and of the downstream slope under steady state seepage for reservoir levels at the principal and emergency spillway crests. Earthquake loading on the dam was not included in the stability analysis. Based on the Recommended Guidelines for Safety Inspection of Dams, there appears to have been adequate stability investigation for the design of this dam. It is noted that the guidelines do not recommend seismic analysis for this dam since it is located in Seismic Zone 1.

C. Operating Records:

No operating records have been obtained.

D. Post-Construction Changes:

No significant post-construction changes were observed or known.

E. Seismic Stability:

This dam is located in Seismic Zone 1, as shown on Plate 3 of Appendix A. In general, it is anticipated that an earthquake of this magnitude would not cause severe structural damage to a well constructed earth dam of this size.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

A. Safety:

A few items are deficient which should be corrected. These items are: (1) thin vegetal cover and erosion gullies on the upstream and downstream faces of the dam; (2) erosion gullies in the approach area and discharge channel of the emergency spillway; (3) steep slope of riprap protection around the spillway inlet structure.

The dam will be overtopped by flows in excess of approximately 34% of the Probable Maximum Flood. Overtopping of an earthen embankment could cause serious erosion and could possible lead to failure of the structure.

B. Adequacy of Information:

The conclusions in this report were based on data from available design and soils reports, as-built drawings and mapping, visual observation of external conditions and performance history as related by others. The inspection team considers that these sources of information are sufficient to support the conclusions herein.

C. Urgency:

The remedial measures recommended in Paragraph 7.2 should be accomplished in the near future. If good maintenance is not provided, the embankment condition will deteriorate and possibly could become serious in the future. The deficiencies concerning the spillway capacity should be given a high priority.

D. Necessity for Additional Inspection:

Based on the results of the Phase I inspection, additional periodic inspections are recommended. However, no Phase II inspection is required.

7.2 REMEDIAL MEASURES:

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

A. Recommendations:

1. The hydraulic capacity of this dam should be increased to safely hold and/or pass the recommended Spillway Design Flood which is 50 percent of the PMF. This is normally accomplished by one or more of the following alternative measures:

(a) Construction of additional spillway capacity.

(b) Provision for additional flood storage by increasing the height of the dam.

B. Operation and Maintenance Procedures:

1. Erosion gullies on the dam and emergency spillway channels should be repaired and reseeded.

2. A program should be set up to maintain the embankment and appurtenant structures.

3. The dam should be periodically inspected by an experienced engineer and records kept of these inspections and maintenance efforts.

4. The dam should be monitored for further erosion in the future and repaired as necessary.

5. The slope of the riprap around the intake structure should be flattened to improve the stability of the riprap.

PHASE I INSPECTION REPORT

APPENDIX A

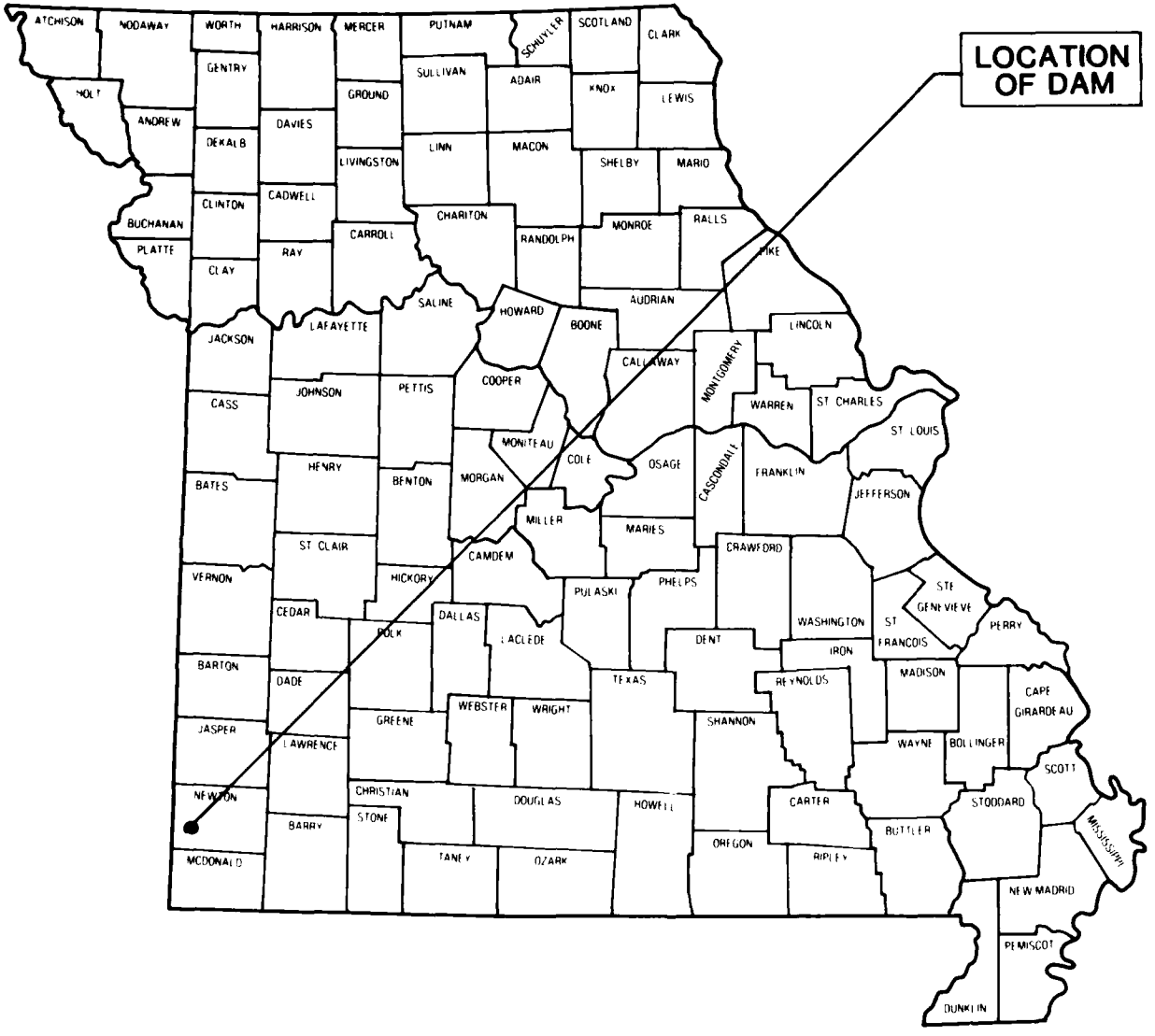
MAPS AND GENERAL DRAWINGS

APPENDIX A

MAPS AND GENERAL DRAWINGS

TABLE OF CONTENTS

Location Map	Plate 1
Vicinity Map	Plate 2
Seismic Zone Map	Plate 3
As-Built Drawings	
General Plan of Reservoir	Sheet 2 of 18
Plan - Typical Section of Embankment	Sheet 3 of 18
General Principal Spillway Layout	Sheet 4 of 18
Abutment Drainage Systems	Sheet 5 of 18
Plan and Profiles for Geologic Investigations	Sheet 16 of 18
Plan and Profiles for Geologic Investigations	Sheet 17 of 18



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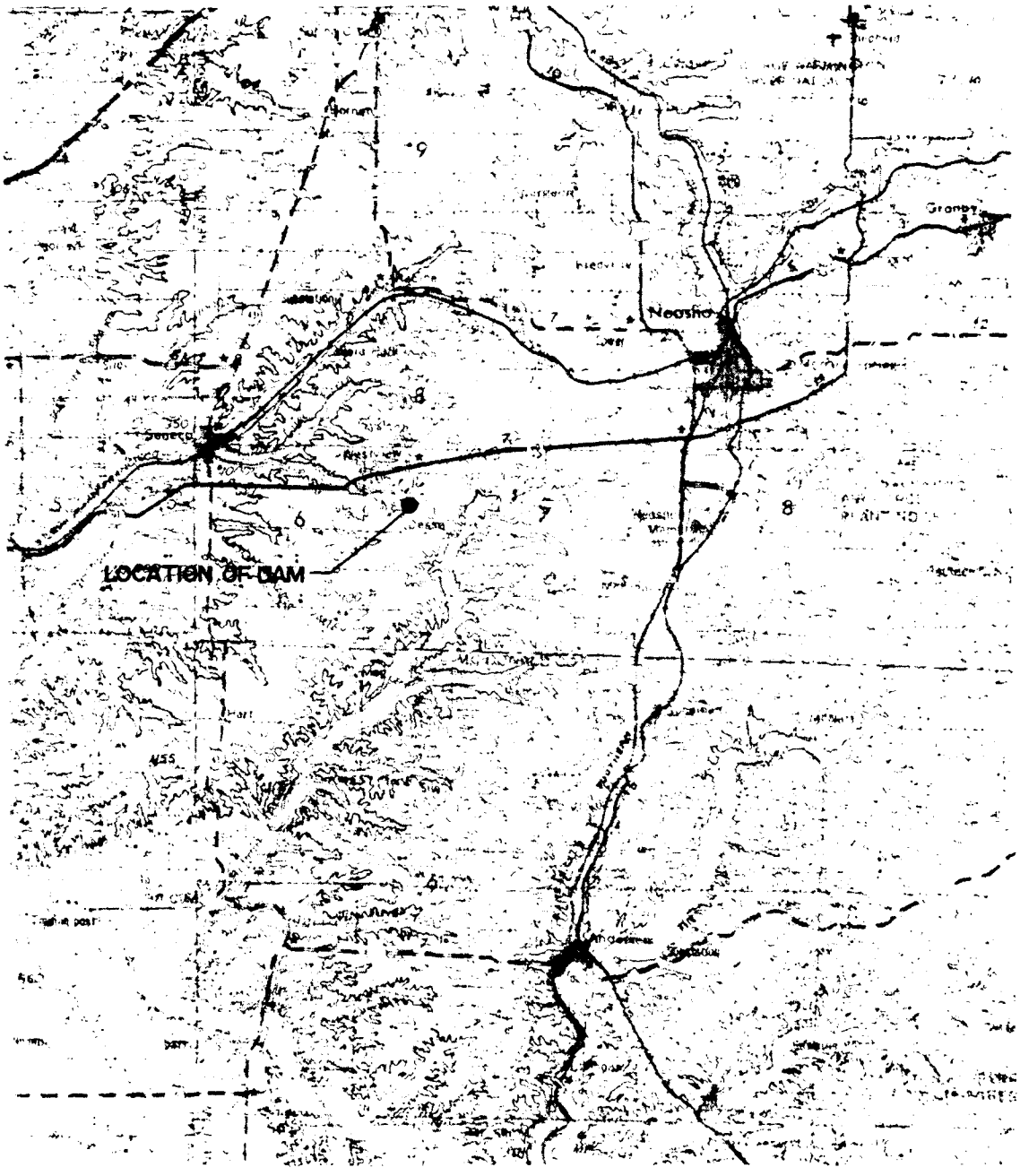
U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
NATIONAL DAM SAFETY PROGRAM

LOCATION MAP
LOST CREEK WATERSHED STRUCTURE D-1 MO20731

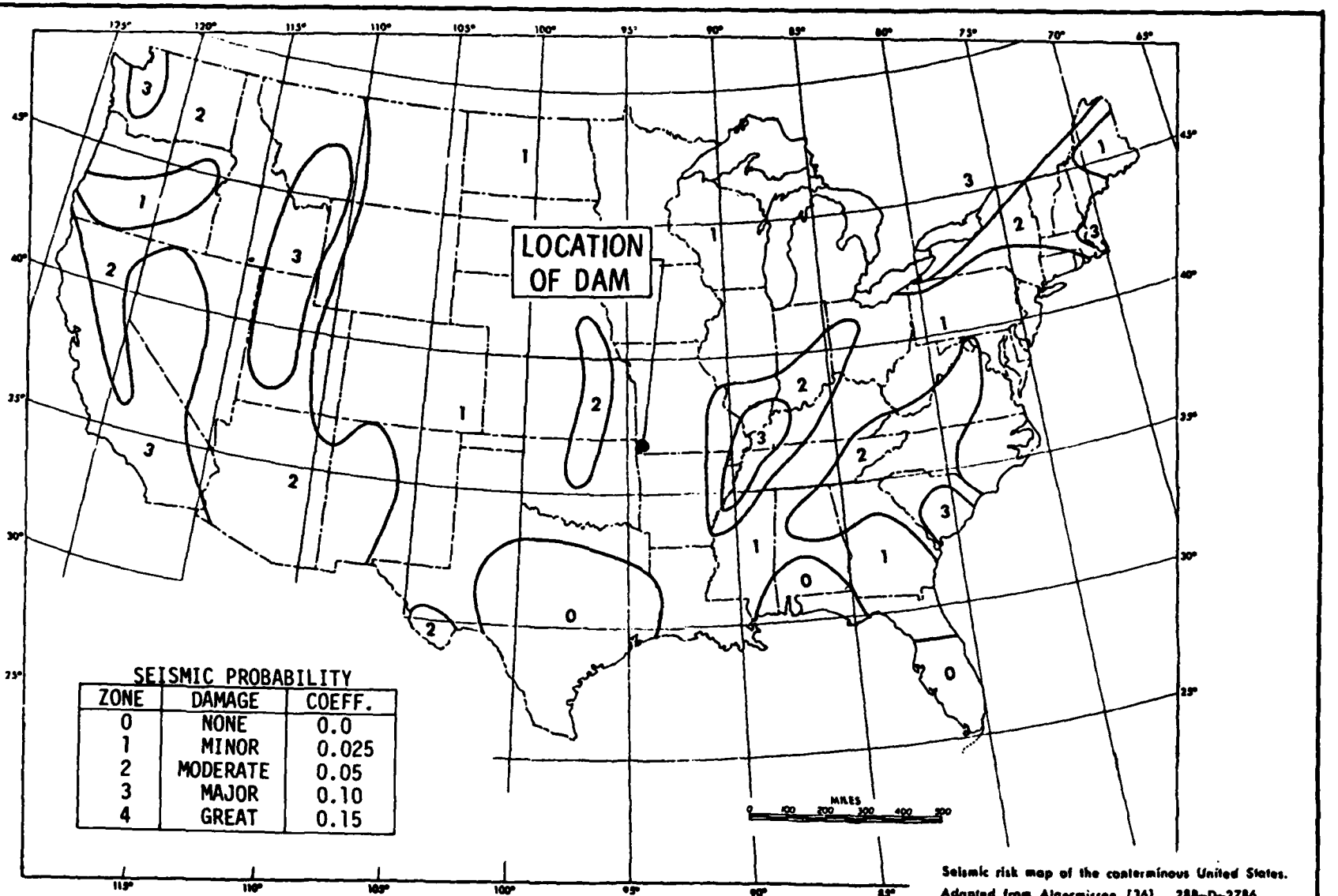


N

SCALE
1: 250,000

CMT	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	VICINITY MAP LOST CK. WATERSD. ST. D-I MO20731

PLATE 2



SEISMIC PROBABILITY

ZONE	DAMAGE	COEFF.
0	NONE	0.0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

Seismic risk map of the conterminous United States.
Adapted from Algermissen [36]. 288-D-2786.

PLATE 3

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CORPS OF ENGINEERS
NATIONAL DAM SAFETY PROGRAM

SEISMIC ZONE MAP OF CONTIGUOUS STATES
LOST CREEK WATERSHED STRUCTURE D-1 M020731

DATA TABLE

Drainage Area, Acres	1044.
Sediment Storage, Acre Feet	56.6
Retarding Storage, Acre Feet	916.6
Sediment Pool, Acres	10.1
Retarding Pool, Acres	38.0

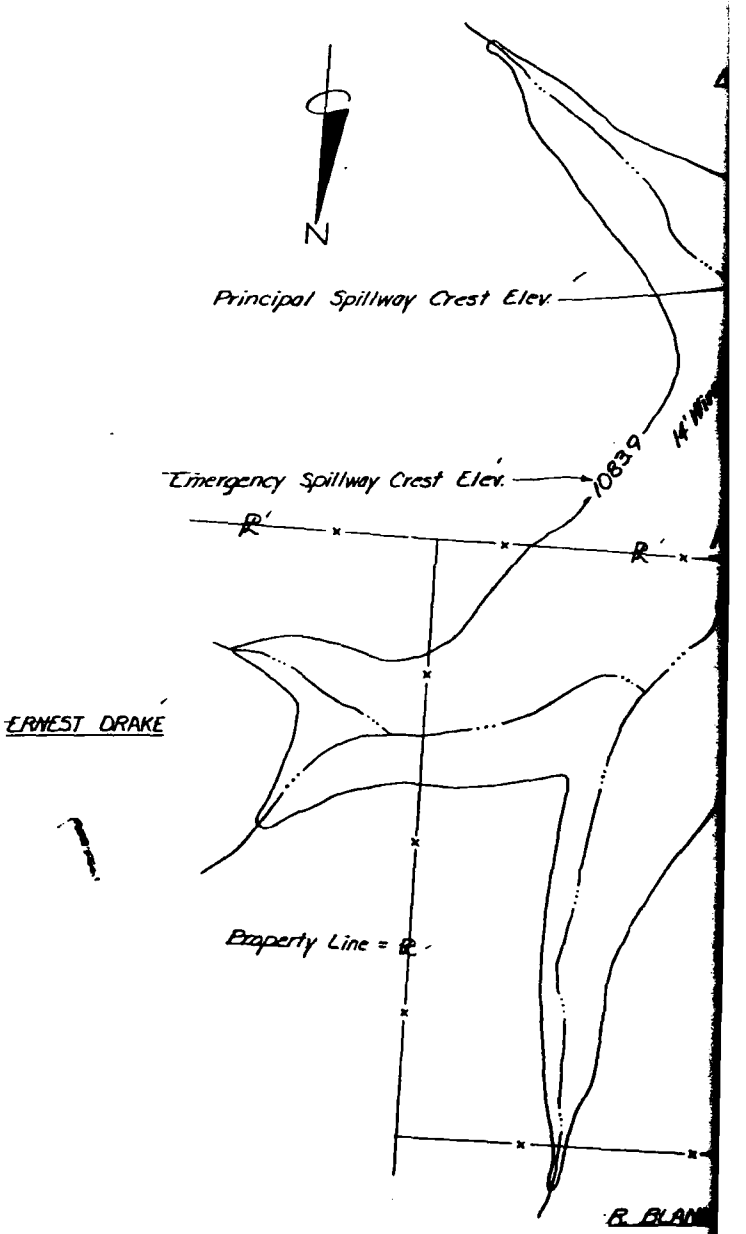
B.M. #1 Elev. 1102.73 Top of Bronze Plate Set in Concrete at Sta. 0+00 Original ℄ Dam.

B.M. #2 Elev. 1097.08 Top of Bronze Plate set in concrete at Sta. 7+76.49 ℄ dam.

Structure D-1 is located approx. 5 miles south of Racine, Mo. in the NW¼ Sec. 17, NE¼ of Sec. 18, T. 24N, R. 33W.

QUANTITIES

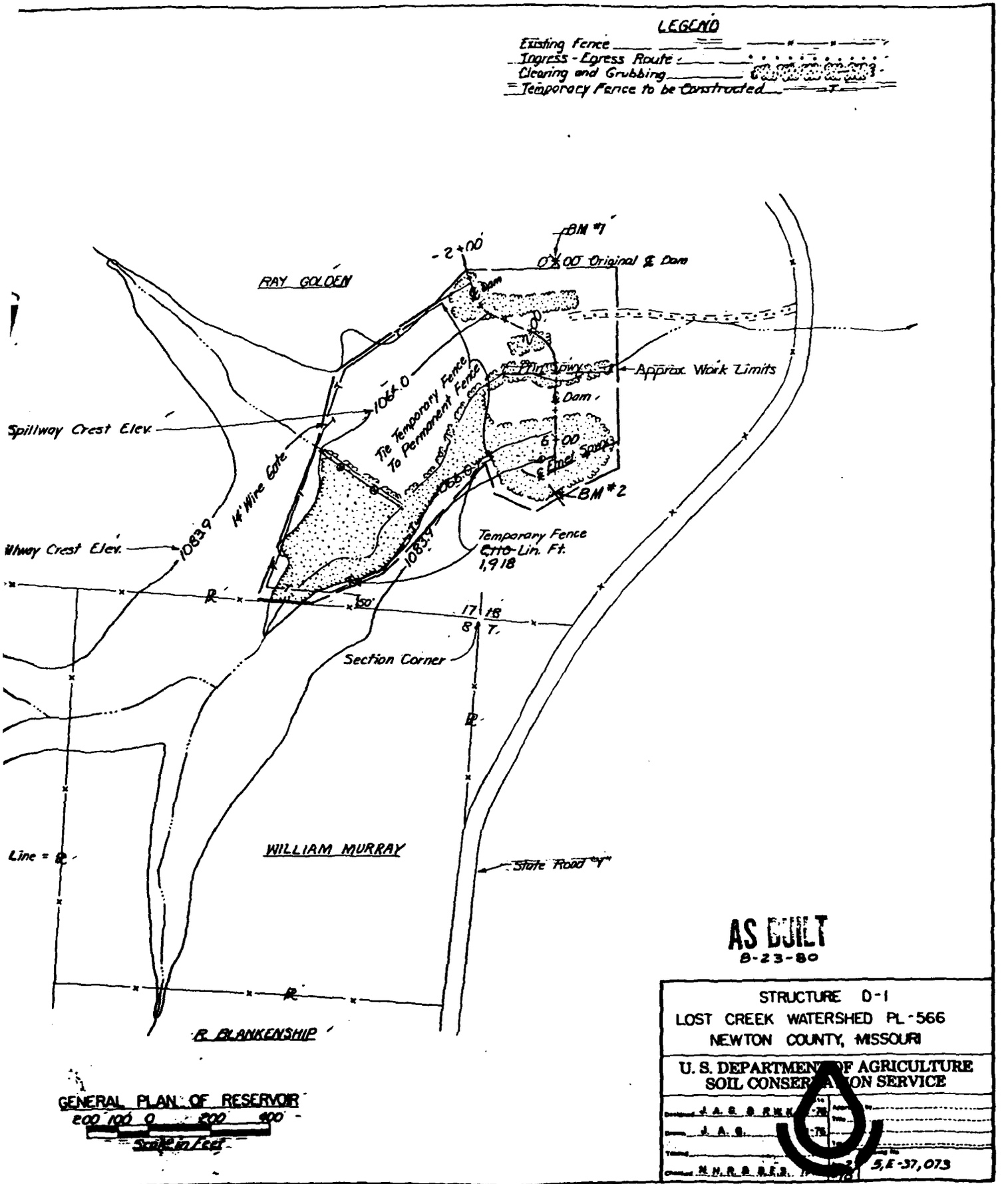
Clearing and Grubbing _____ Lump Sum
(Approx. 7.7 Acres)

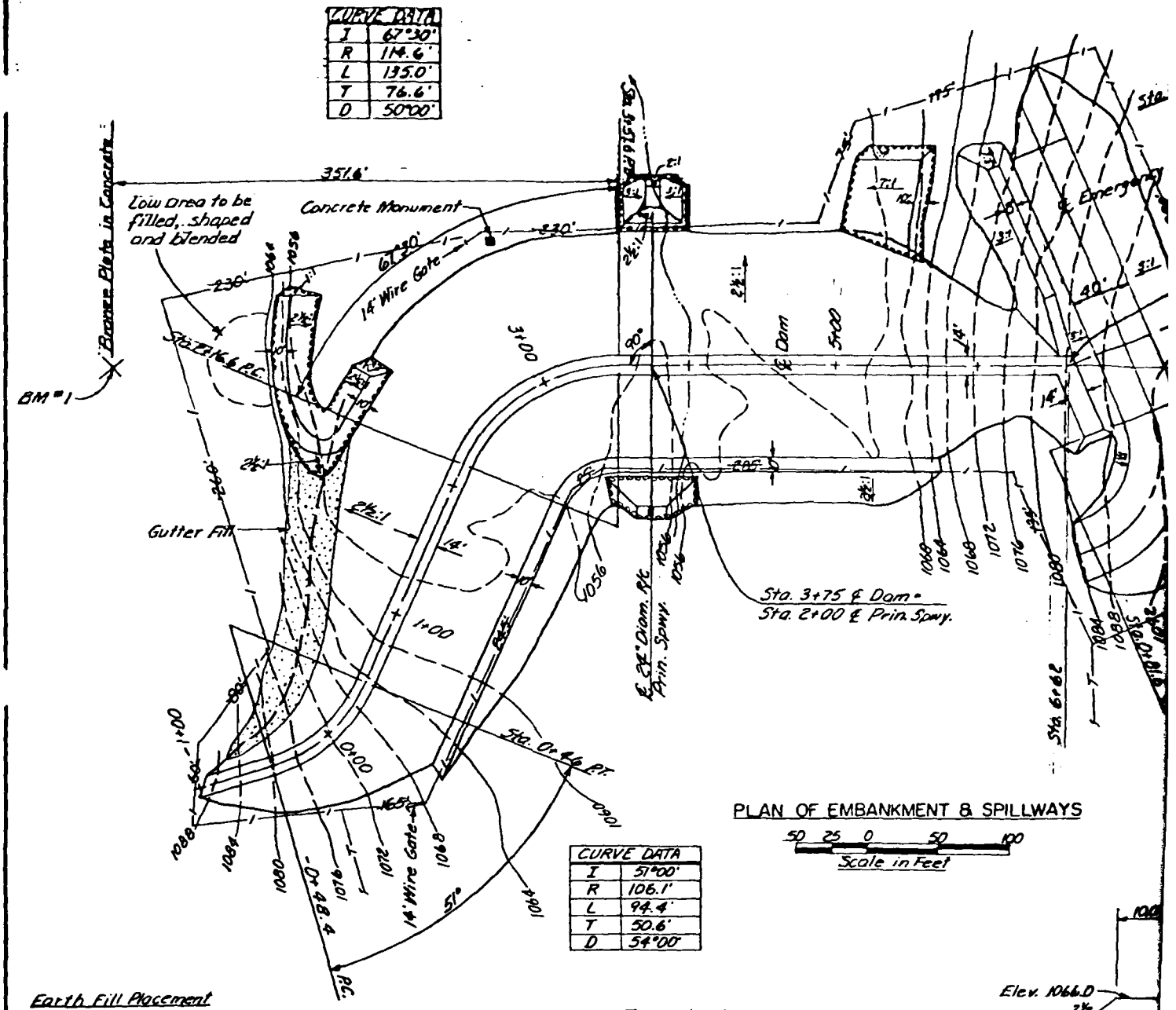


GENERAL PLAN OF RESE

200 100 0 200

Scale in Feet


LEGEND
Existing Fence
Ingress - Egress Route
Clearing and Grubbing
Temporary Fence to be Constructed
BM #1
-2+00
0+00 Original ℄ Dam
RAY GOLDEN
℄ Dam
Pipe Spillway
Approx. Work Limits
℄ Dam
6+00
℄ Emer. Spwy.
BM #2
1064.0
Tie Temporary Fence To Permanent Fence
Spillway Crest Elev.
14' Wire Gate
1063.0
Temporary Fence
Qtty-Lin. Ft.
1,918
Wkway Crest Elev.
1063.9
1063.9
℄
150'
17
18
8
T.
Section Corner
℄
Line = ℄
WILLIAM MURRAY
State Road "Y"
℄
R. BLANKENSHIP
GENERAL PLAN OF RESERVOIR
200 100 0 200 400
Scale in Feet
AS BUILT
8-23-80
STRUCTURE D-1
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
J. A. S. & R. W. K.
J. A. S.
N. H. R. & E. S.
5,E-37,073



PLAN OF EMBANKMENT & SPILLWAYS

50 25 0 50 100
Scale in Feet

Elev. 1066.0

Earth Fill Placement

1. Place the more plastic fine grained soil materials (CL) in Zone 1. This material would be similar to the soil from 0 to 7 feet in test hole 105.
2. Place the finer grained gravels (GC) with the most fines in the interior portion of Zone 2.
3. Place the coarser grained gravels (GC-GM) with the least fines in the exterior portion of Zone 2.
4. The gutter on the left abutment shall be filled with Class C, Zone 2, Earth Fill as directed by the Engineer. This fill shall be the coarsest gravel or cobbles with the least fines available. Rock size may exceed 9" for this area.
5. Zone 2, Class C, Earth Fill placed adjacent to the abutment drains shall be a gravel or cobble material with the least fines available.

Earth Fill Placement Cont'

6. Backfill around the principal spillway shall be with 4 inch lifts

TYPI

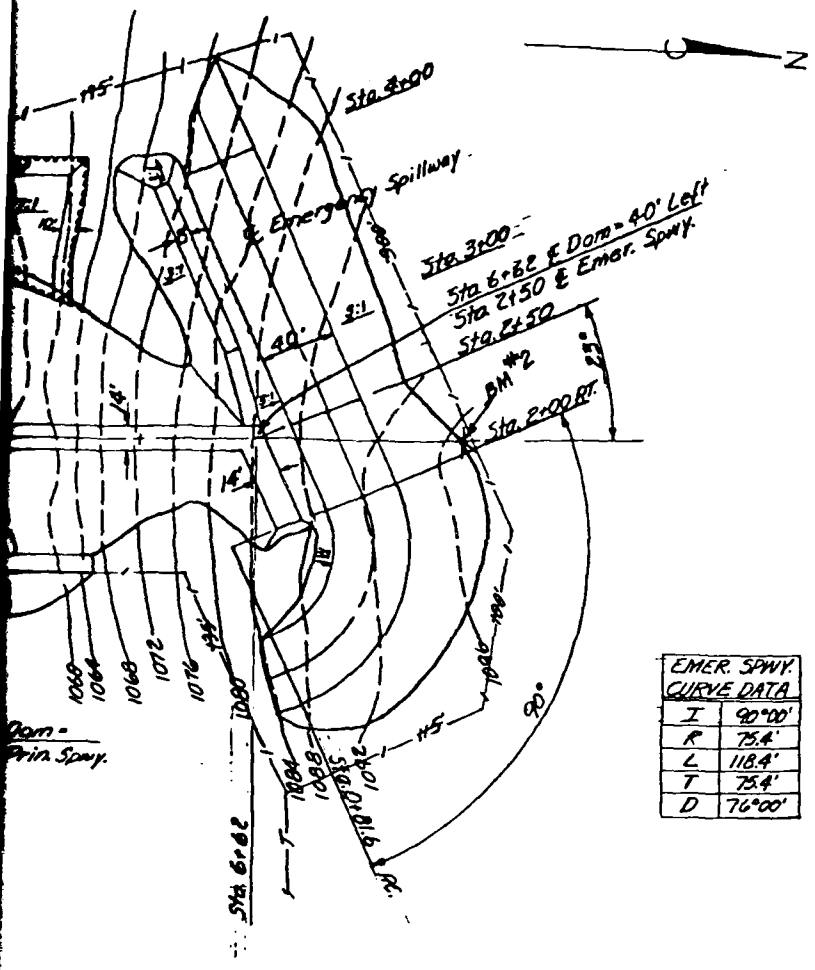
*Includes Emergency Spillway and other requir

EMBANKMENT MATERIAL SOURCES & PLACEMENT REQUIREMENTS

EMBANK-MENT ZONE	SOURCE OF MATERIAL: LOCATION	APPROX. DEPTH (FT.) FROM	TO	UNIFIED SOIL CLASSIFIC.	PLACEMENT & MOISTURE DENSITY REQUIREMENTS: DEPTH OF LIFT	MAX. SIZE ROCK FRAGMENTS	FILL MATRIX SIZE TESTED	COMPACTION CLASS	REFERENCE TEST METHOD	REQ'D (%) COMPACTION	ALLOWABLE MOISTURE CONTENT
1	* Borrow Area	0	7	CL	9"	6"	Minus #4	A	ASTM D-698 Method A	95	Optimum and Above
2	* Borrow Area	1	10	GC & GM	9"	9"	—	C	—	—	5 Percent and Above

LABORATORY TEST INFORMATION

Sample No.	105
Unified Soil Classification	CL
Reference Test Method	ASTM Meth
Maximum Dry Density (P.C.F.)	10
Optimum Moisture – %	1
Percent Finer Than No. 200 Sieve	
Percent Finer Than No. 4 Sieve	



EMER. SPWY. CURVE DATA	
I	90°00'
R	75.4'
L	118.4'
T	75.4'
D	76°00'

LEGEND

Fence to be Constructed
Rock Riprap Area
Gutter Fill Area
Protective Dike

NOTES:

Topsoil
A minimum of six (6) inches of topsoil shall be placed on all compacted earth fill and in the emergency spillway.

Waste Area
Waste areas will be as directed by the Engineer.

Rock Riprap
For further details of rock riprap placement see sheet 5.

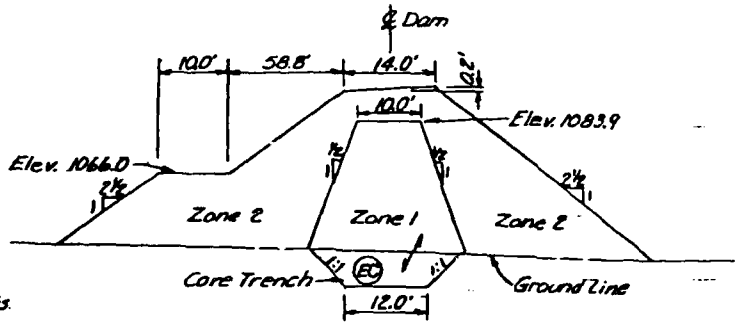
Temporary Fence
Layout of temporary fence is as shown on sheet 2.

QUANTITIES		
Excavation, Common (EC)		
Core Trench	5,755 ~~5,600~~	Cu. Yds.
Structure	132 ~~170~~	Cu. Yds.
Stilling Basin	141 ~~130~~	Cu. Yds.
Total	6,028 ~~5,910~~	Cu. Yds.
Earth Fill		
Class (A), Zone 1	19,623 ~~19,400~~	Cu. Yds.
Class (C), Zone 2	52,877 ~~60,400~~	Cu. Yds.
~~Rock Riprap, Equipment Placed~~	~~1,200~~	~~Cu. Yds.~~
Topsoil	3511 *~~7460~~	Sq. Yds.
~~Seeding & Mulching~~	~~16.2~~ 76.7	Acres
Temporary Seeding	0 ~~3.6~~	Acres
Fence, Barbed Wire	2458 ~~2480~~	Lin. Ft.
Temporary Fence, Barbed Wire	~~2118~~ 2,110	Lin. Ft.

*3511 / ~~2460~~ sq. yds. topsoil at a depth of six (6) inches is equivalent to ~~577~~ 585 cu. yds.

ANKMENT & SPILLWAYS

50 100
e in Feet



TYPICAL SECTION OF EMBANKMENT

Cont'
the principal
with 4 inch lifts.

ergency Spillway and other required excavations.

ABORATORY TEST INFORMATION ON TYPICAL MATERIALS			
mple No.	105-1	114-2	204-1
ified Soil Classification	CL	GC	GM
ference Test Method	ASTM D-698 Method A	—	—
imum Dry Density (P.C.F.)	107.0	112.0	—
timum Moisture - %	18.0	14.5	—
rcent Finer Than No. 200 Sieve	79	23	21
rcent Finer Than No. 4 Sieve	85	41	28

AS BUILT
8-25-80

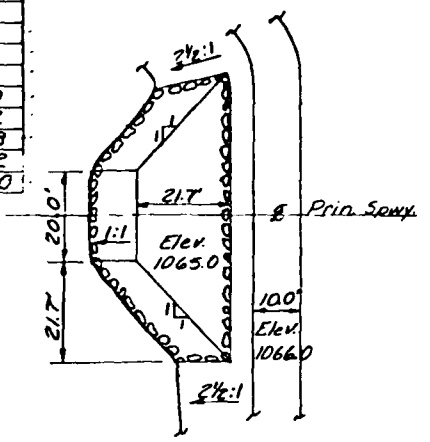
STRUCTURE D-1
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed R.W.K.
Drawn R.E.B.
Traced
Checked R.W.K. & N.H.B.
J. H. Randall
Head Design Section
5,E-37,073

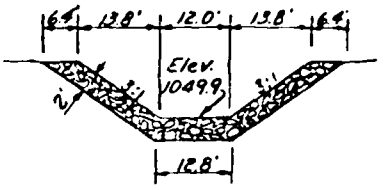
SCS-ENG-313-B Rev. 7-69

PIPE CAMBER	
Distance From Outlet	Elevation
0	1055.00
—	—
24	1055.23
40	1055.45
56	1055.66
72	1055.85
88	1056.04
104	1056.20
120	1056.34
136	1056.48
152	1056.60
168	1056.72
184	1056.83
200	1056.92
208	1057.00

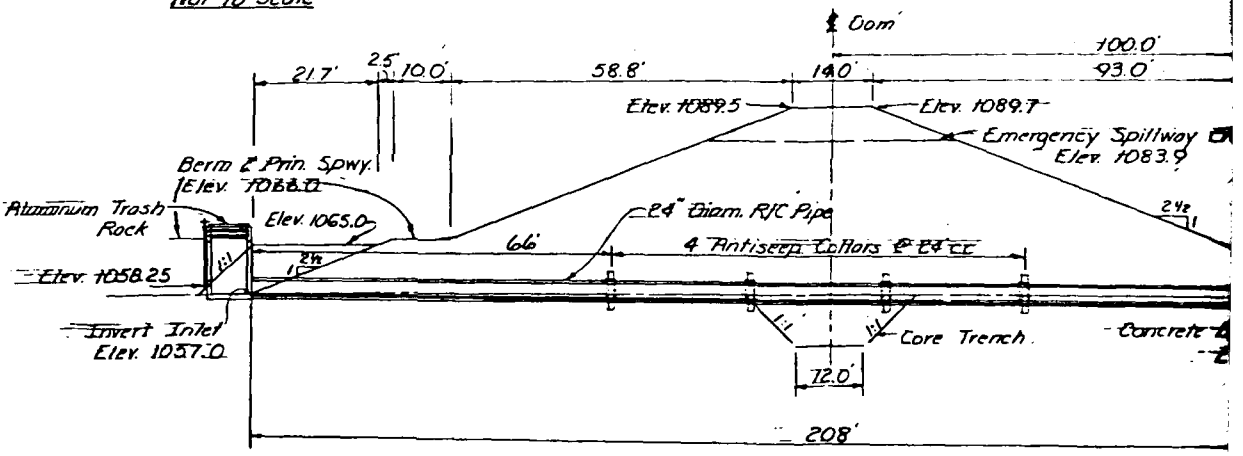
NOTES:
1. Pipe elevations other than those shown will be furnished by the engineer when required.
2. Antiseeps shall not be placed closer than two (2) feet to a pipe joint.



PARTIAL PLAN-EYEBROW BERM
Not to Scale



TYPICAL SECTION-STILLING BASIN
Not to Scale

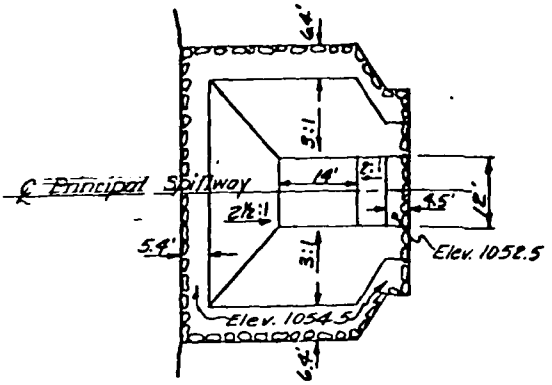


SECTION ON CENTERLINE

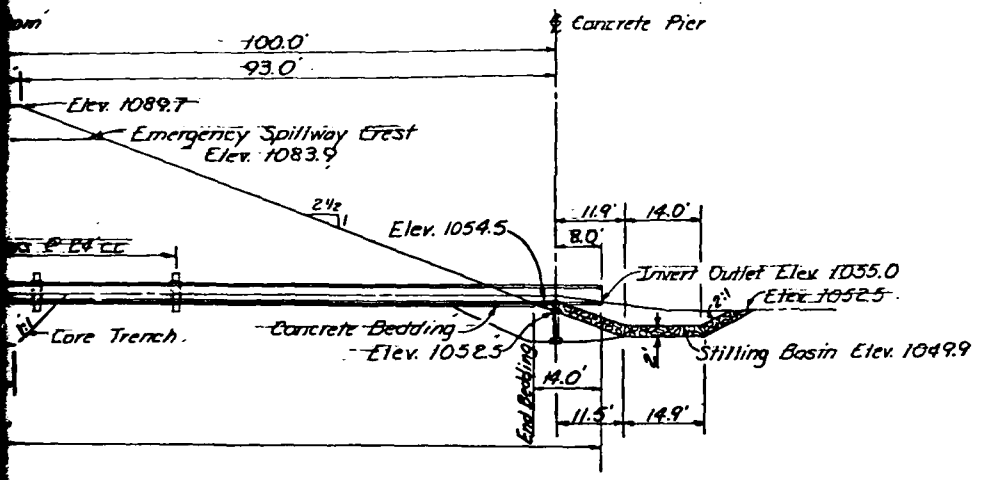
16' 8' 0 16 32
Scale in Feet

MATERIALS

Concrete, Class 4000
Steel Reinforcement
Prestressed Concrete Pressure Pipe, 24" Diam, Steel Cylinder Type
Aluminum Trash Rock
Slide Gate, 12" Diam.



PARTIAL PLAN - OUTLET



TERLINE

32

MATERIALS

	32.7 Cu. Yds.
	2,083 Pounds
Steel Cylinder Type	208 Lin. Ft.
	Lump Sum
	1 Each

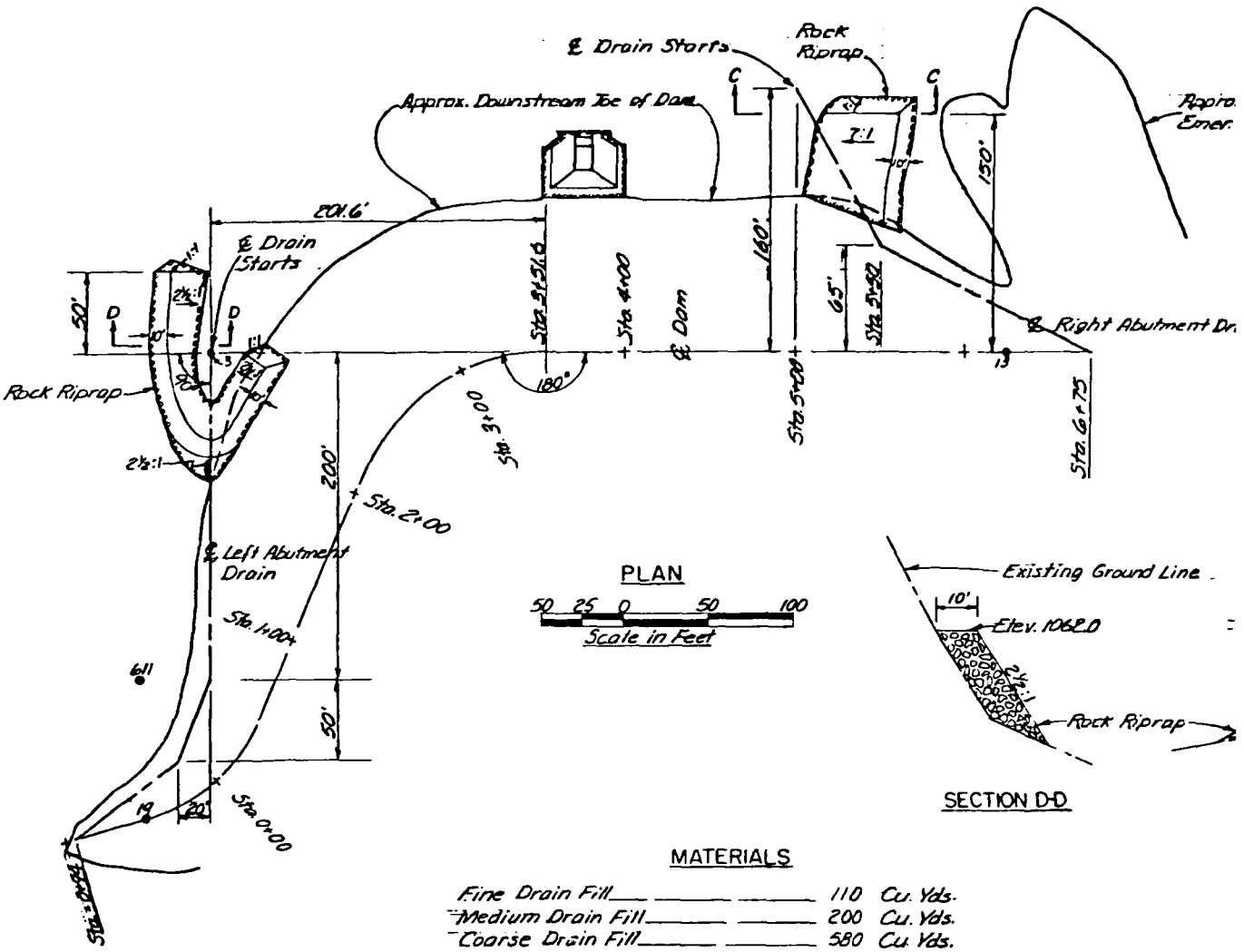
AS BUILT
8-23-80

STRUCTURE D-1
GENERAL LAYOUT
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

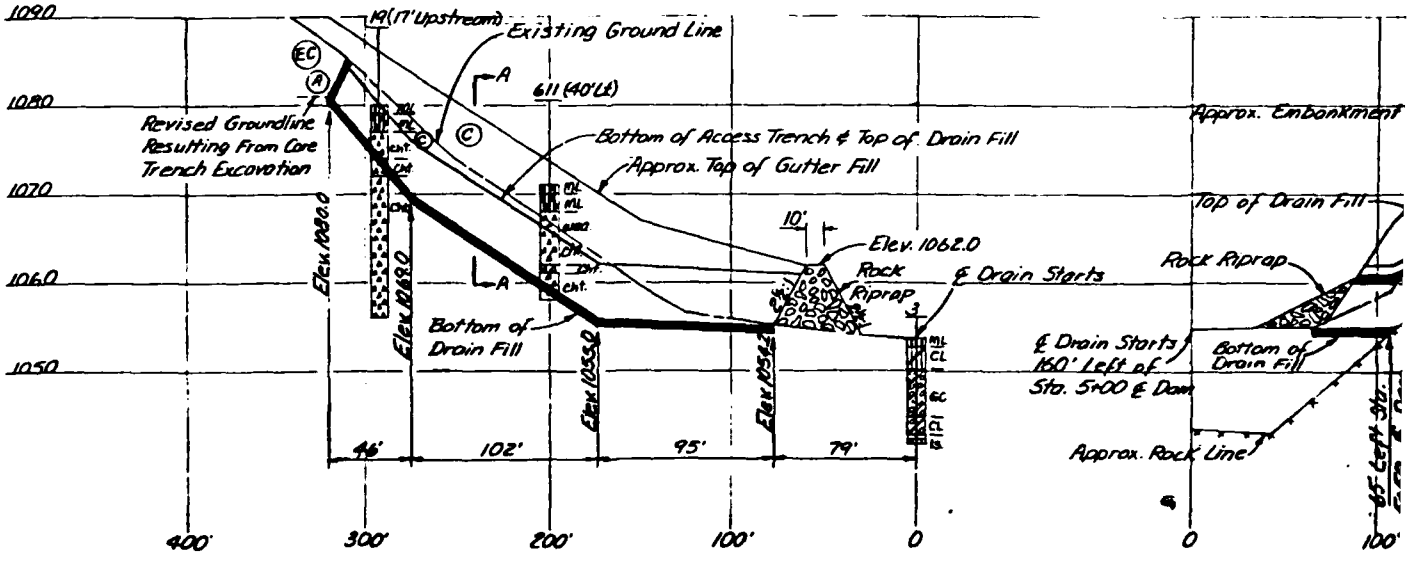
Designed R.W.K. -77
Drawn J.A.G. -77
Traced
Checked B.F.S. & H.M.B.

S.C.S.-37,073



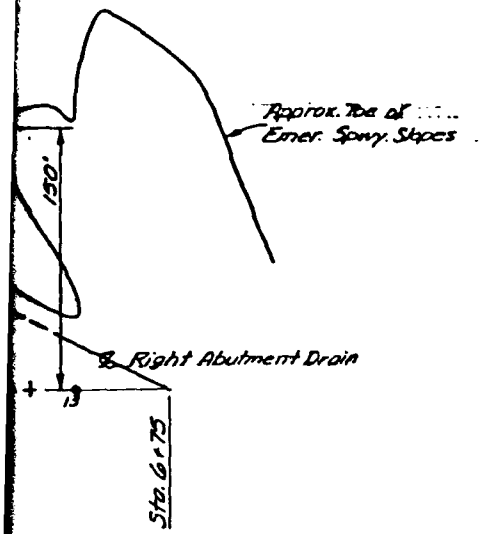
MATERIALS

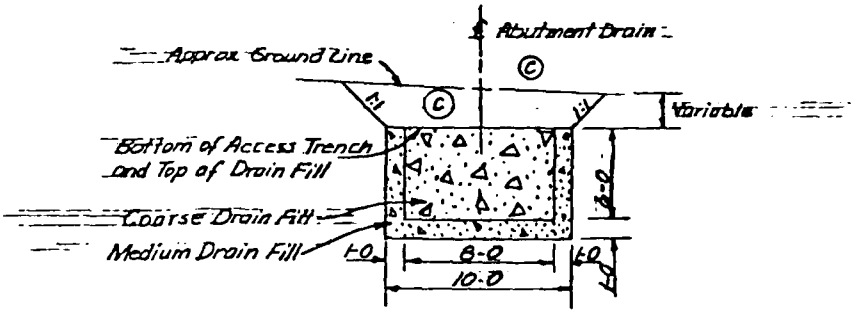
Fine Drain Fill	110 Cu. Yds.
Medium Drain Fill	200 Cu. Yds.
Coarse Drain Fill	580 Cu. Yds.
Total Drain Fill	890 Cu. Yds.



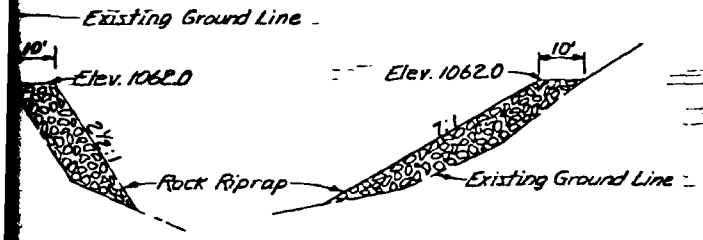
SECTION ON CENTERLINE
LEFT ABUTMENT DRAINAGE SYSTEM

SECTION C
RIGHT ABUTM



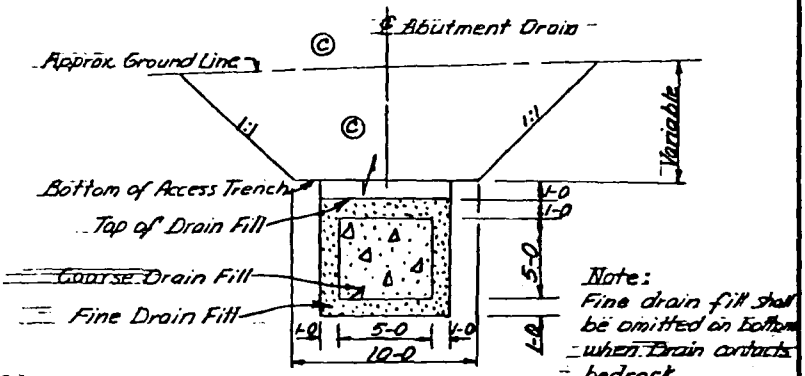


SECTION A-A



SECTION D-D

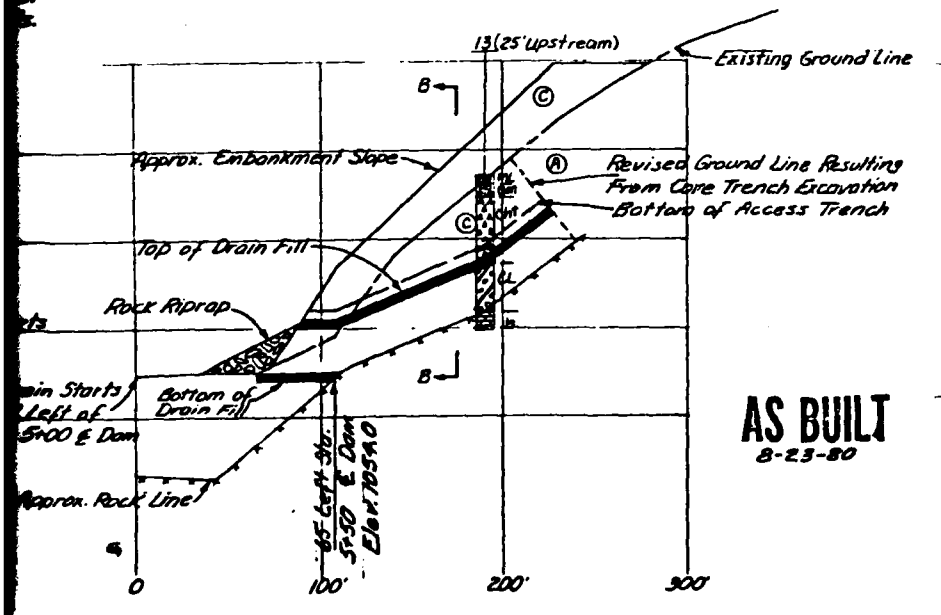
SECTION C-C



SECTION B-B

NOTES:
1. Zone 2, Class C, Earth Fill placed in the gutter on the left abutment shall be the coarsest gravels or cobbles with the least fines available.
2. Zone 2, Class C, Earth Fill placed adjacent to the drain fill shall be a gravel and cobble material with the least fines available.
3. The drain fill shall conform to the following gradation:

	Sieve Size	Percent Passing
Fine Drain Fill	3/8"	100
	#4	95-100
	#8	80-100
	#16	50-85
	#30	25-60
	#50	10-30
	#100	2-10
Medium Drain Fill	Medium drain fill shall consist of a 50-50 mixture of fine drain fill and coarse drain fill.	
Coarse Drain Fill	1"	100
	3/4"	90-100
	3/8"	20-55
	#4	0-10
	#8	0-5



AS BUILT
8-23-80

SECTION ON CENTERLINE
RIGHT ABUTMENT DRAINAGE SYSTEM

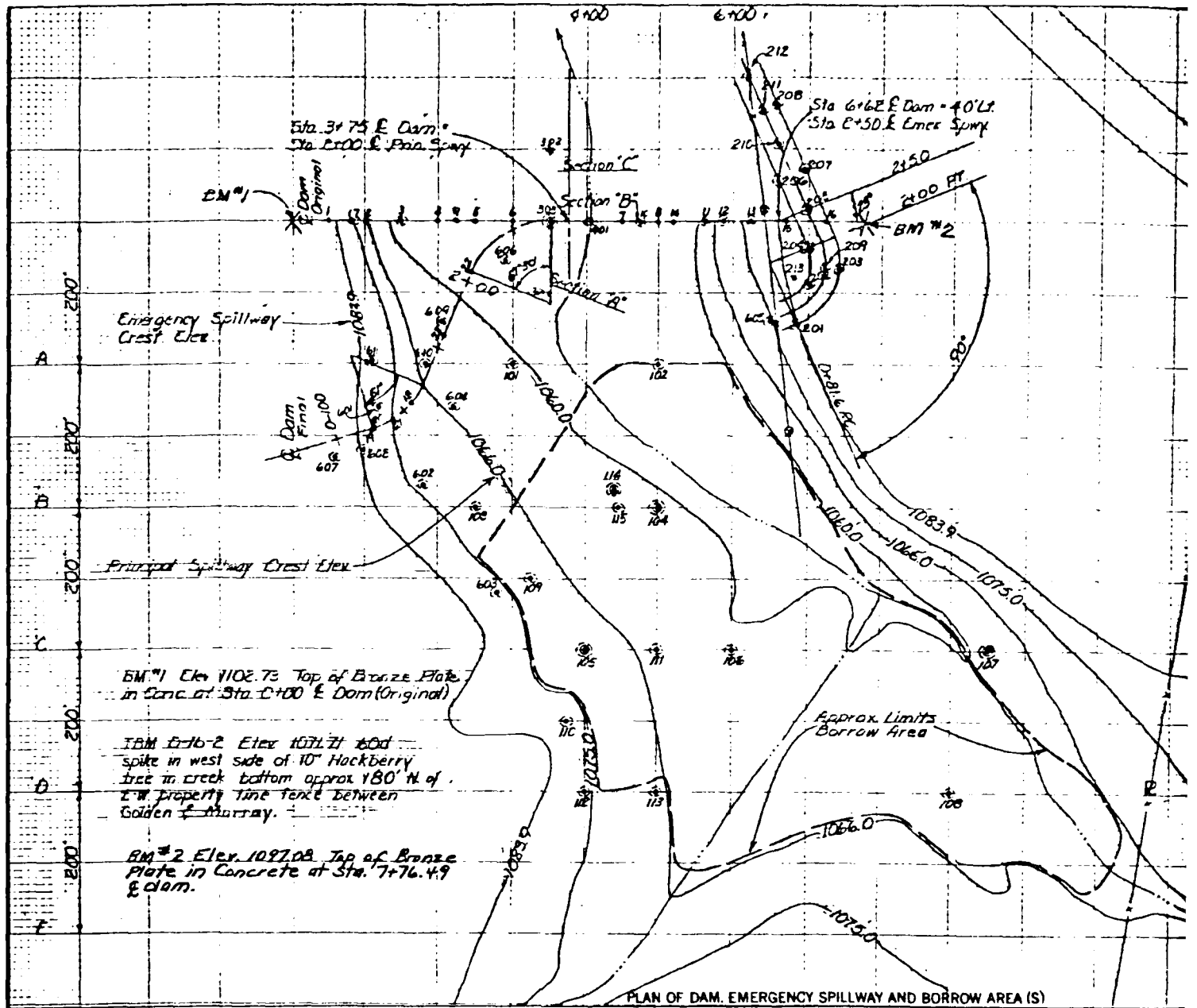
STRUCTURE D-1
ABUTMENT DRAINAGE SYSTEMS
LOST CREEK WATERSHED FL-566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

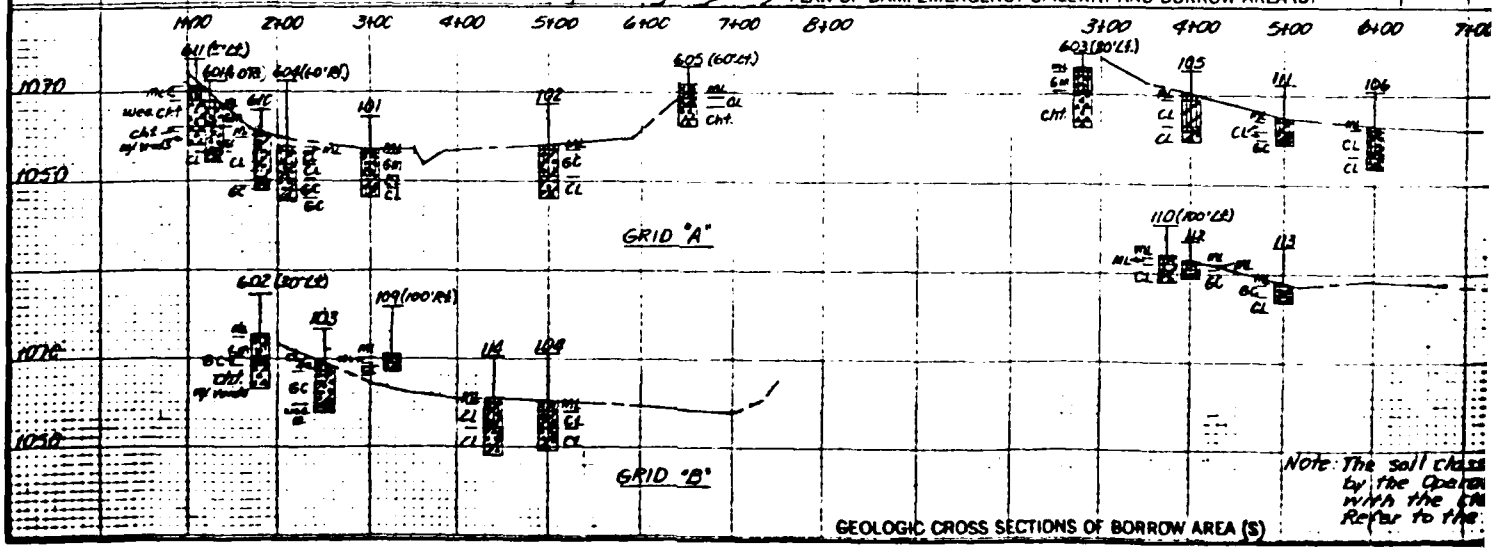
Designed R.W.K.
Drawn R.F.S.
Traced
Checked R.W.K. & H.N.R.

5,E-37,075

SCS-ENG-315-B Rev. 7-69

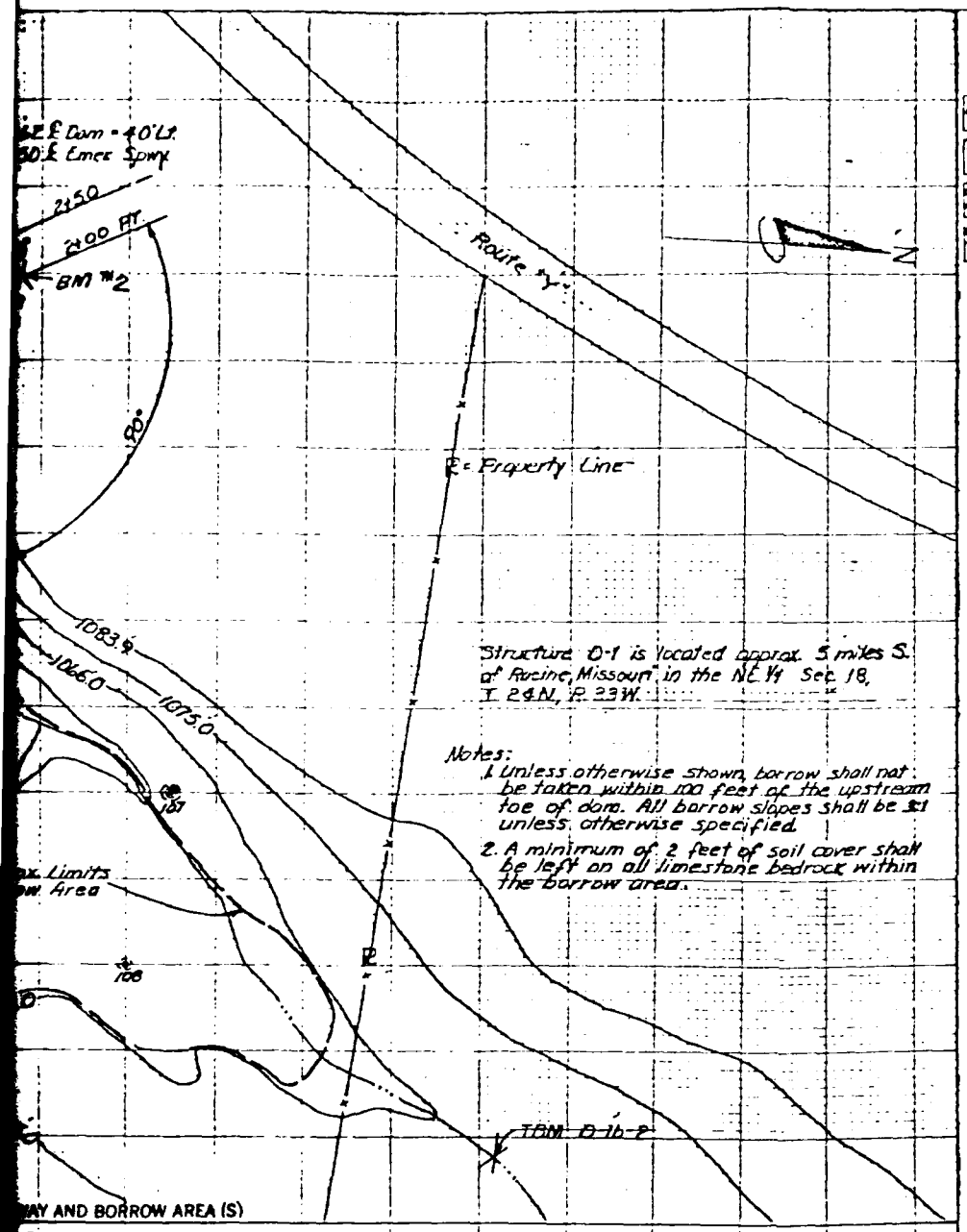


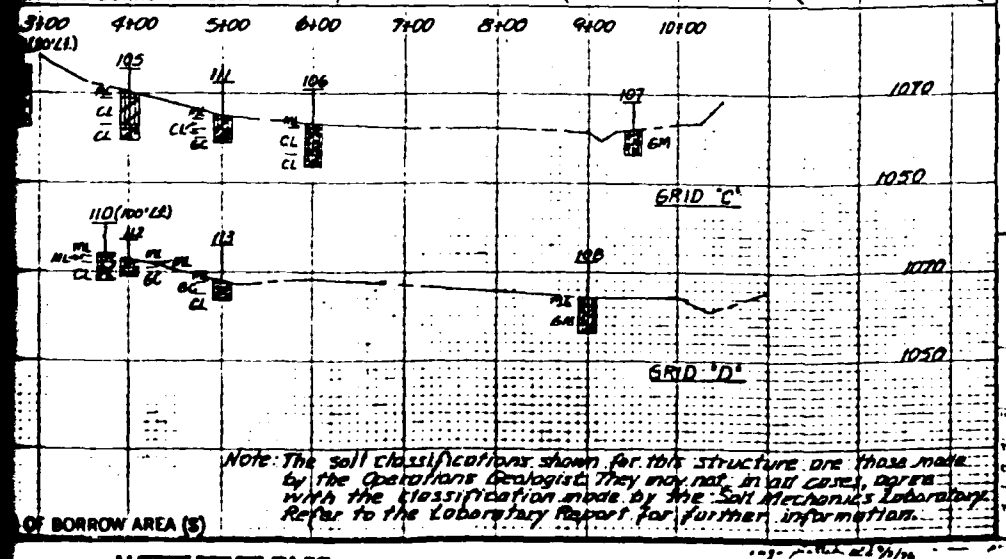
PLAN OF DAM, EMERGENCY SPILLWAY AND BORROW AREA (S)



GEOLOGIC CROSS SECTIONS OF BORROW AREA (S)

Note: The soil class... by the Operat... with the Cit... Refer to the...





Note: The soil classifications shown for this structure are those made by the Operations Geologist. They may not, in all cases, agree with the classification made by the Soil Mechanics Laboratory. Refer to the Laboratory Report for further information.

LEGEND

SYMBOLS

UNCONSOLIDATED MATERIAL

gravel; sand; silt; clay; rock fragments, boulders; gravel, sandy; sand, gravelly; silt, gravelly; clay, gravelly; peat or muck; gravel, silty; sand, silty; silt, sandy; clay, sandy; gravel, clayey; sand, clayey; silt, clayey; clay, silty

CONSOLIDATED MATERIAL

Sedimentary Rocks

Conglomerate Cng.; shale sh.; limestone ls.; coal; breccia bec.; siltstone slst.; dolomite dol.; gypsum gyp.; sandstone ss.; marl; chalk ch.; chert cht.

Metamorphic Rocks

gneiss; schist; quartzite; slate; marble; soapstone talc serpentine

Igneous Rocks

intrusive; extrusive; pyroclastic

Undifferentiated

Other Symbols

hole logged only; hole sampled; strike and dip; pit or trench

ABBREVIATIONS

ang.	angular	lam.	laminated	G	gravel, gravelly
bld.	boulders (> 12")	los.	loose	S	sand, sandy
calc.	calcareous	mas.	massive	M	silt, silty
cali.	caliche	med.	medium	C	clay, clayey
cav.	cavities	mic.	micaceous	O	organic
cmt.	cemented	mod.	moderately	W	well graded
cse.	coarse	n. r.	no recovery	P	poorly graded
cbl.	cobbles (3"-12")	per.	permeable		
cpt.	Compact	po.	poorly		
con.	concretions	rdd.	rounded		
xln.	crystalline	sl/.	slightly		
ds.	dense	sft.	soft		
dip.	dipping	s/.	some		
d.s.	downstream	slo.	slowly		
fn.	fine	stf.	stiff		
frm.	firm	t.b.	thin-bedded		
frac.	fractured	b/ff.	buffaceous		
frg.	fragments	u.s.	upstream		
fri.	friable	var.	variable		
grn.	grain	v/.	very		
gyp.	gypseous	w/.	with		
hd.	hard	wea.	weathered		
h.	highly	w.l.	(data) static water level		

TEST HOLE NUMBERING SYSTEM

Centerline of dam	1 - 99	Stream channel	401 - 499
Borrow area	101 - 199	Relief wells	501 - 599
Emergency spillway	201 - 299		601 - 699
Centerline of outlet structure	301 - 399		701 - 799

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

GW	Well graded gravels, gravel-sand mixtures
GP	Poorly graded gravels
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well graded sands, sand-gravel mixtures
SP	Poorly graded sands
SM	Silty sand
SC	Clayey sands, sand-clay mixtures
ML	Silts with liquid limit of 50 or less
MH	Silts with liquid limit above 50
CL	Clays with liquid limit of 50 or less
CH	Clays with liquid limit above 50
OL	Organic silts and clays with liquid limit of 50 or less
OH	Organic silts and clays with liquid limit above 50

Revised February 1969

AS BUILT

PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS

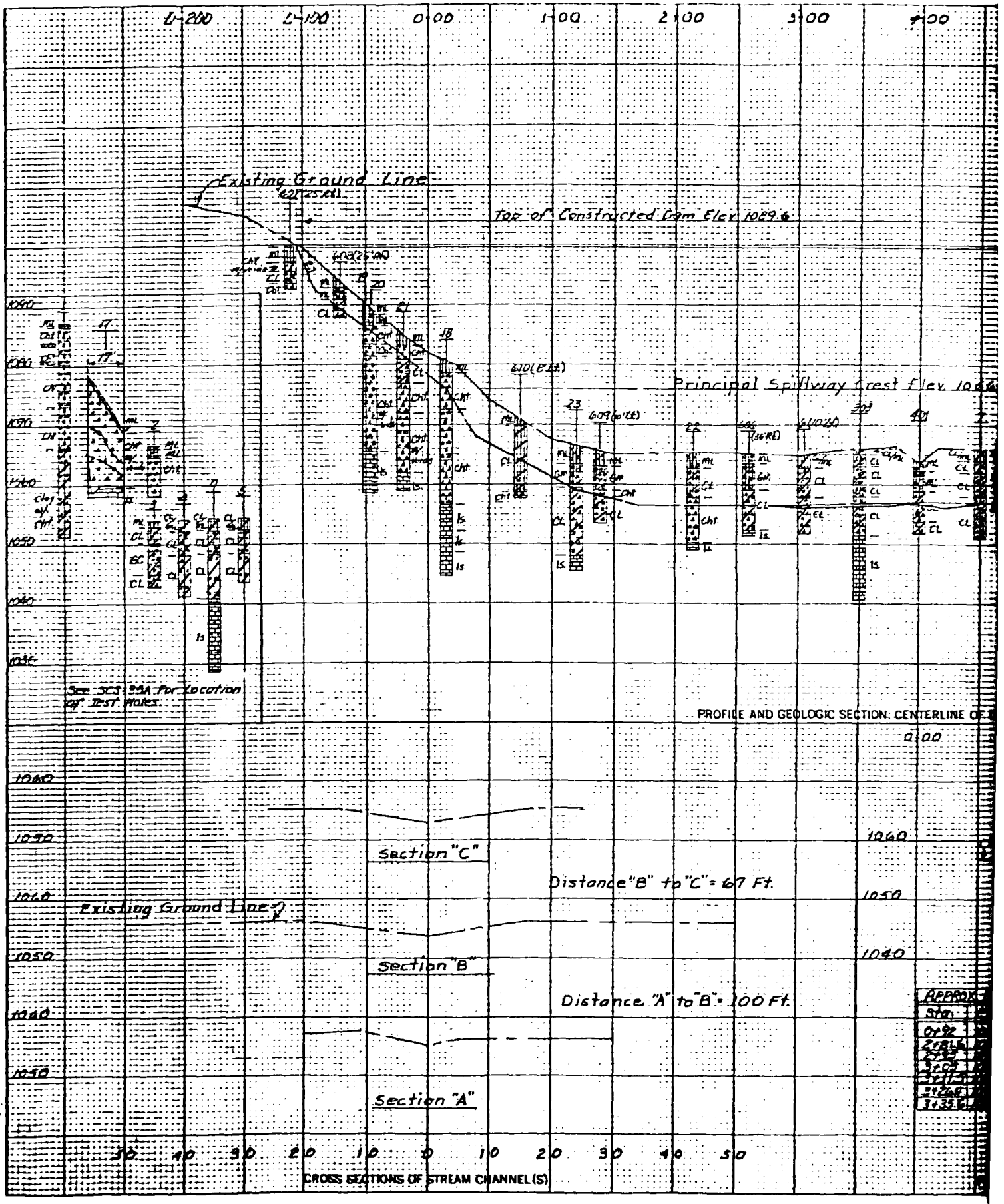
STRUCTURE D-1

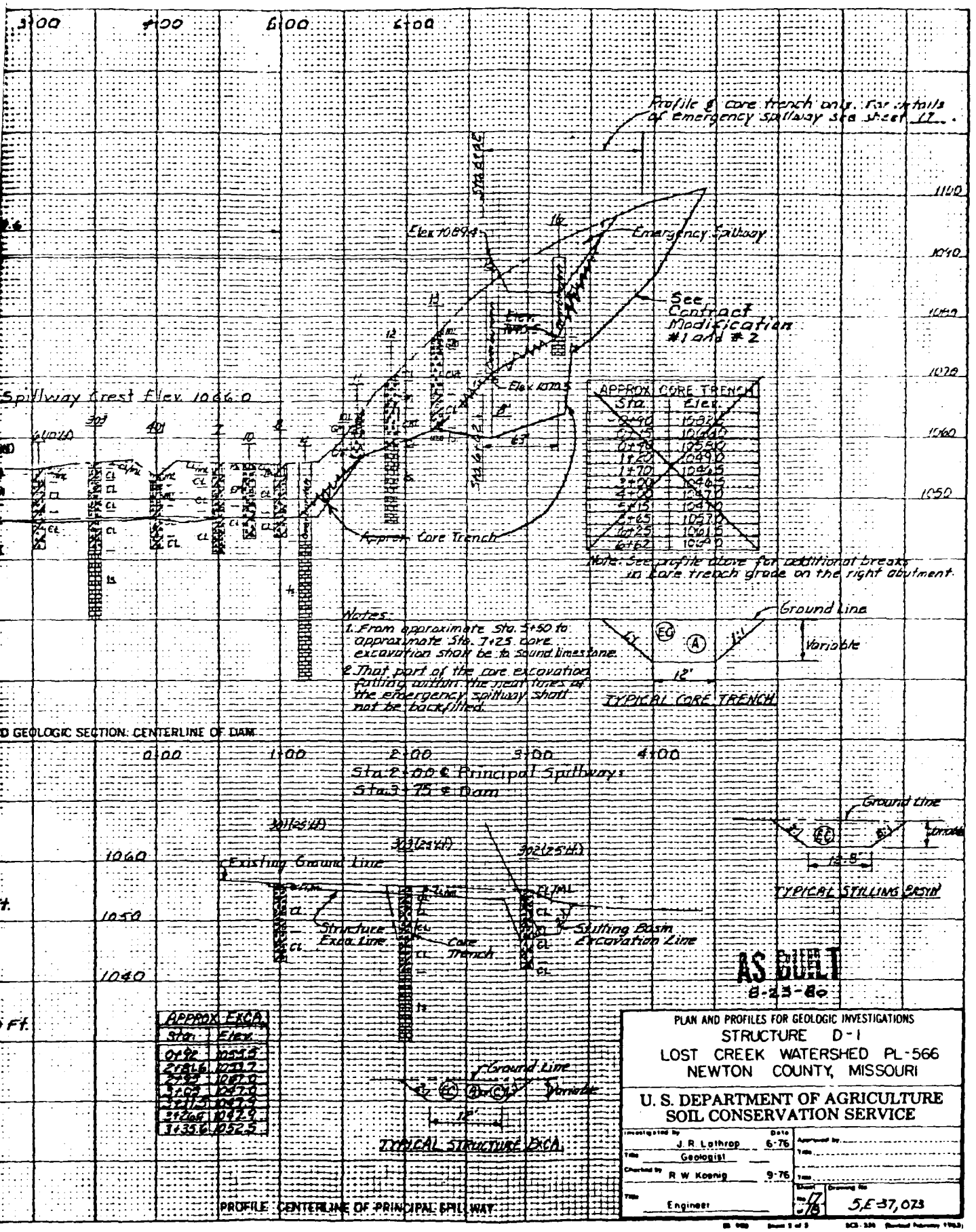
LOST CREEK WATERSHED PL-566

NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by J R Lothrop	Date 6-76	Approved by	
Title Geologist		Title	
Checked by R W Koenig	9-76	Title	
Title Engineer		Sheet no. 16 of 18	Drawing No. S,E-37,073


Existing Ground Line
Top of Constructed Dam Elev 1029.6
Principal Spillway Crest Elev 1040
See SCS-99A for location of Test Holes.
PROFILE AND GEOLOGIC SECTION: CENTERLINE OF
Section "C"
Distance "B" to "C" = 67 Ft.
Existing Ground Line
Section "B"
Distance "A" to "B" = 100 Ft.
Section "A"
CROSS SECTIONS OF STREAM CHANNEL(S)



AS BUILT
8-23-80

PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS
STRUCTURE D-1
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by J. R. Lathrop	Date 6-76	Approved by	
Title Geologist		Title	
Checked by R. W. Koenig	9-76	Title	
Title Engineer		Sheet No. 17 of 78	Drawing No. 5-E-37,073

PHASE I INSPECTION REPORT

APPENDIX B

HYDROLOGIC AND HYDRAULIC ANALYSIS

APPENDIX B

HYDROLOGIC AND HYDRAULIC ANALYSIS

TABLE OF CONTENTS

Section	Title	Page No.
A.	Purpose	B-1
B.	Hydrologic and Hydraulic Analysis	B-1
C.	References	B-5

EXHIBITS

Number	Title
1	Lake and Watershed Map
2	Elevation-Area-Capacity Relation
3	Profile of Dam Crest
4	Emergency Spillway Flowline Profile
5	Emergency Spillway Cross Section
6	HEC-1 Input Data
7	Inflow and Outflow, 34% PMF
8	Inflow and Outflow, 50% PMF
9	Inflow and Outflow, 100% PMF
10	HEC-1 Summary Table

APPENDIX B

HYDROLOGIC AND HYDRAULIC ANALYSIS

A. PURPOSE:

The purpose of this Appendix is to present the methodology used and the results of the hydrologic and hydraulic analysis. The analysis was done according to criteria presented in the Recommended Guidelines for Safety Inspection of Dams and in the St. Louis District Hydrologic/Hydraulic Standards for Phase I Safety Inspection of Non-federal Dams dated 22 August 1980. The purpose of the analysis is to determine the overtopping potential for Lost Creek Watershed Structure D-1.

B. HYDROLOGIC AND HYDRAULIC ANALYSIS:

The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The unit hydrograph was determined by using the time of concentration given on the "as-built" drawings and applying the Soil Conservation Service formulas found in Design of Small Dams to determine the SCS lag time which was input to the HEC-1 computer program. A check of the time of concentration was done using data obtained from the field inspection and from the U. S. Geological Survey 7.5 minute quadrangle maps for Seneca, Missouri-Oklahoma dated 1949 and photorevised 1978, and for Neosho West, Missouri, dated 1972. The check showed that the time of concentration shown on the "as-built" drawings was adequate. The parameters used in the development of the unit hydrograph are presented in Table 1 along with the unit hydrograph values computed by the HEC-1 computer program.

TABLE 1

UNIT HYDROGRAPH PARAMETERS

Drainage Area (A)	1.63 sq. miles
Time of Concentration (Tc) - from "as-built" drawings	0.9 hours
Lag Time (Lg)	0.54 hours
Duration (D)	0.20 hours

(SCS formula used: Lg = 0.6 Tc)

Unit Hydrograph from the HEC-1 Computer Output

Time (Hours)	Discharge (cfs)
0	0
0.2	253
0.4	862
0.6	1224
0.8	1102
1.0	745
1.2	425
1.4	261
1.6	156
1.8	93
2.0	56
2.2	34
2.4	20
2.6	13
2.8	8
3.0	4

The hypothetical storm that is applied to the unit hydrograph is the Probable Maximum Precipitation (PMP). It is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." No reduction factors have been applied to the PMP. A 1 percent probability storm was also analyzed. A 48-hour storm duration is assumed with total depth distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions.

A Soil Conservation Service curve number of 71 for Antecedent Moisture Condition II (AMC II) was used for the design of the dam. A check of the curve number revealed that it was applicable. The use of AMC III results in a curve number of 88 which was used for the analysis of the PMP percentage storms. The rainfall-runoff parameters are presented in Table 2.

TABLE 2

RAINFALL-RUNOFF PARAMETERS

Selected Storm Event	Storm Duration (hours)	Rainfall (inches)	Runoff (inches)	Losses (inches)
PMP	48	38.73	37.20	1.53

Additional Data: 1) Percentage of Drainage Basin Impervious = 4 percent.

The reservoir routing is accomplished by using the Modified Puls routing technique in which the flood hydrograph is routed through lake storage. The hydraulic capacity of the spillways and the crest of the dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The elevation-storage capacity curve determined during the design of the dam was used for this analysis. The hydraulic capacity of the spillway and top of the dam are defined by elevation-discharge curves.

For the overtopping analysis the top of the dam is the lower of the following elevations: (1) The minimum elevation of embankment as determined by simple field surveys. (2) The lake elevation at which corresponding outflow velocities, as determined from simple hydraulic formula, exceed the suggested maximum permissible mean channel velocities. The top of the dam was determined to be 1088.8 which is the minimum elevation of the embankment. Outflow velocities in the emergency spillway when the lake is at this elevation are at or below the suggested maximum permissible mean channel velocities for grass-lined channels with silt clay soil. Therefore only minor erosion of the emergency spillway channel is expected by flows when the lake level is at or below the top of the dam.

The elevation-discharge capacity curve for the top of the dam was developed using the non-level crest option of the HEC-1 computer program. The program assumes critical flow over a broad-crested weir. A profile of the dam crest is given on Exhibit 3.

The hydraulic capacity of the principal spillway was determined using formulas for weir control and pipe control. The hydraulic capacity of the emergency spillway was determined using methods found in the U. S. Department of Agriculture Soil Conservation Service Technical Release No. 2, Earth Spillways, dated October 1, 1956. The profile of the spillway flow line and cross sections of the emergency spillway channel were used in this determination and they are shown on Exhibits 4 and 5. The elevation-spillway capacity input to the computer is shown in Table 3.

TABLE 3

LAKE ELEVATION VS. SPILLWAY CAPACITY

Values Input To The HEC-1 Computer Program

Lake Elevation (MSL)	Spillway Capacity (cfs)	
1065.5	0	
1066.0	13.2	Principal spillway
1066.5	37.2	flow, weir control

TABLE 3

LAKE ELEVATION VS. SPILLWAY CAPACITY

Values Input To The HEC-1 Computer Program

Continued

Lake Elevation (MSL)	Spillway Capacity (cfs)	
1067.0	39.9	Principal spillway flow, pipe control
1068.0	41.6	
1070.0	44.9	
1074.0	50.7	
1078.0	55.9	
1082.0	60.6	
1083.4	62.2	
1084.4	117	Principal spillway flow, pipe control plus emergency spillway flow
1085.4	291	
1086.4	595	
1087.4	1043	
1088.4	1595	
1089.4	2292	
1090.4	3080	

The dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This analysis determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being effectively overtopped. According to Hydrologic/Hydraulic Standards developed by the Corps of Engineers, St. Louis District, an antecedent storm should be applied to the watershed before analysis of the PMF. The antecedent storm precedes the storm being analyzed by 4 days and the starting elevation at the beginning of the antecedent storm is the mean annual high water mark. Since this lake has not yet been filled, the principal spillway crest elevation was taken as the starting elevation at the beginning of the antecedent storm. The antecedent storm for the analysis of the PMF ratio storms is a storm half the magnitude of the storm being analyzed. All antecedent storms will pass through the spillways and the lake will return to within 0.5 feet of the elevation of the principal spillway crest. Therefore the principal spillway crest elevation was used as the starting elevation for the analysis of the PMF ratio storms.

The above methodology has been accomplished for this report using the systematized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site and input to the program are listed on Exhibit 6, Definitions of these variables are contained in the "User's Manual" for the computer program.

The computer printout of the inflow to the lake and the outflow from the lake for the 34% PMF, 50% PMF, and 100% PMF are presented on Exhibits 7, 8 and 9 respectively. The computer printout summary table for the overtopping analysis is presented on Exhibit 10.

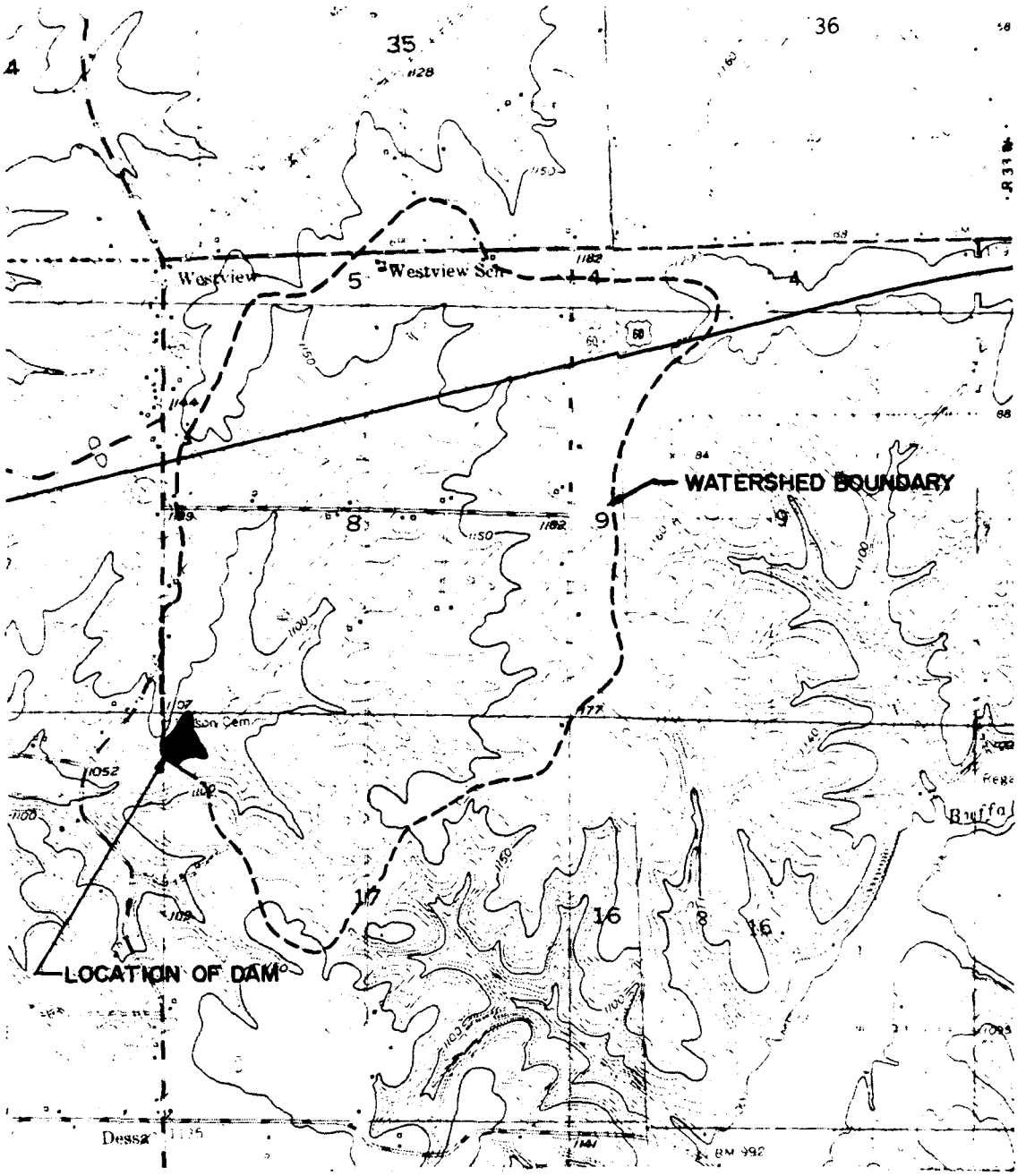
C. REFERENCES:

a. Design of Small Dams, United States Department of the Interior, Bureau of Reclamation, Second Edition, 1973.

b. Earth Spillways, Technical Release No. 2, Soil Conservation Service, United States Department of Agriculture, Engineering Division, October, 1956.

c. Flood Hydrograph Package (HEC-1), Users Manual for Dam Safety Investigations, The Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California; September, 1978.

d. Riedel, J. T., Appleby, J. F., and Schloemer, R. W., Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1000 Square Miles and Durations of 6, 12, 24 and 48 Hours, Hydrometeorological Report No. 33, U. S. Department of Commerce, Weather Bureau, April 1956.



CMET	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	LAKE AND WATERSHED MAP LOST CK. WATERSD. ST. D-I MO20731

EXHIBIT 1

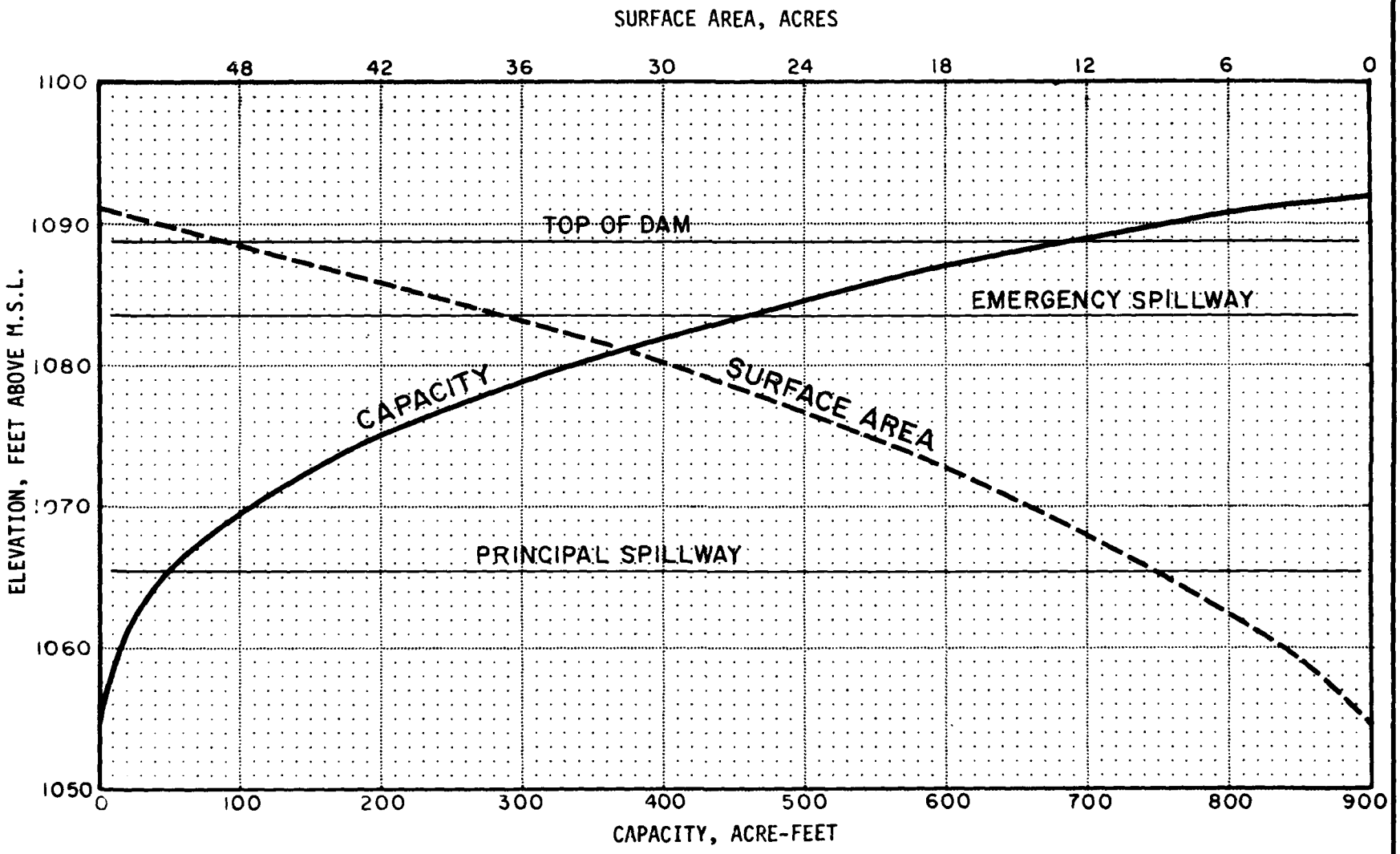


EXHIBIT 2

CHRISTOPHER BURKE & STELLE Inc. Consulting Engineers SPRINGFIELD, IL • LINCOLN, IL • AURORA, IL	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	**ELEVATION - AREA - CAPACITY RELATION** **LOST CREEK WATERSHED STRUCTURE D-1 MO20731**

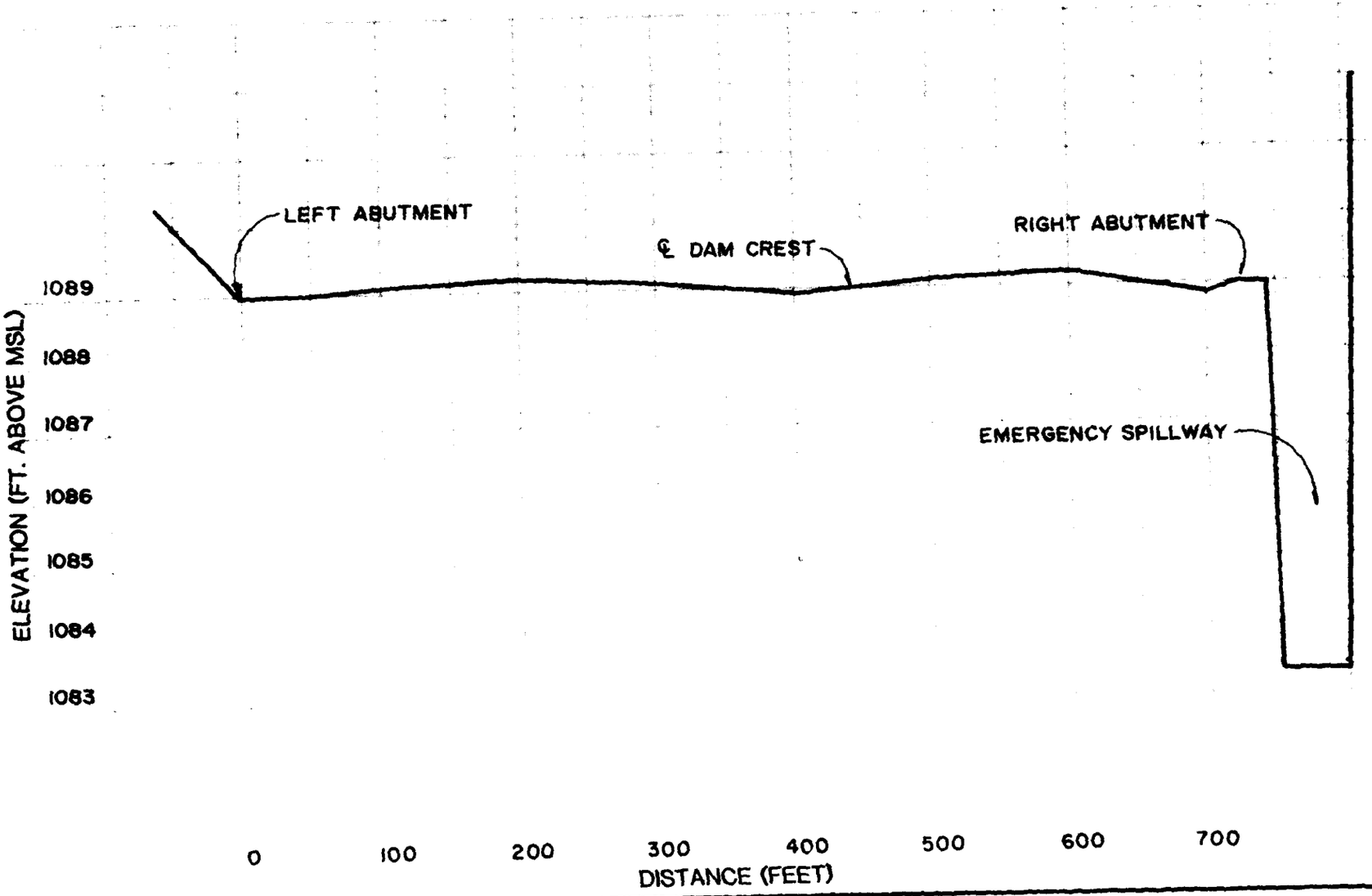


EXHIBIT 3

CRAWFORD, MURPHY & TILLY, Inc. Consulting Engineers SPRINGFIELD, IL • LINCOLN, IL • AURORA, IL	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	PROFILE OF DAM CREST LOST CREEK WATERSHED STRUCTURE D-1 MO20731

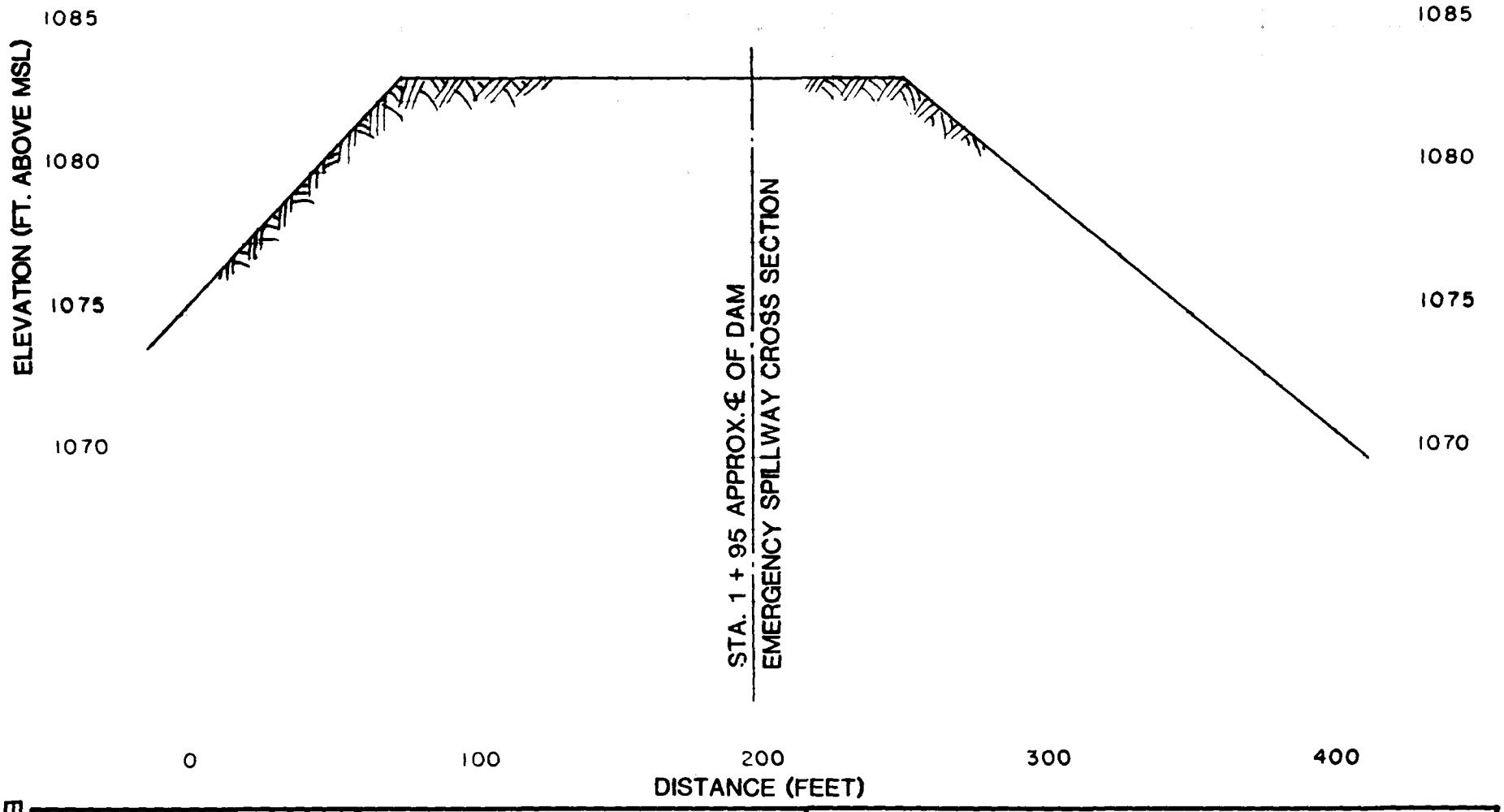
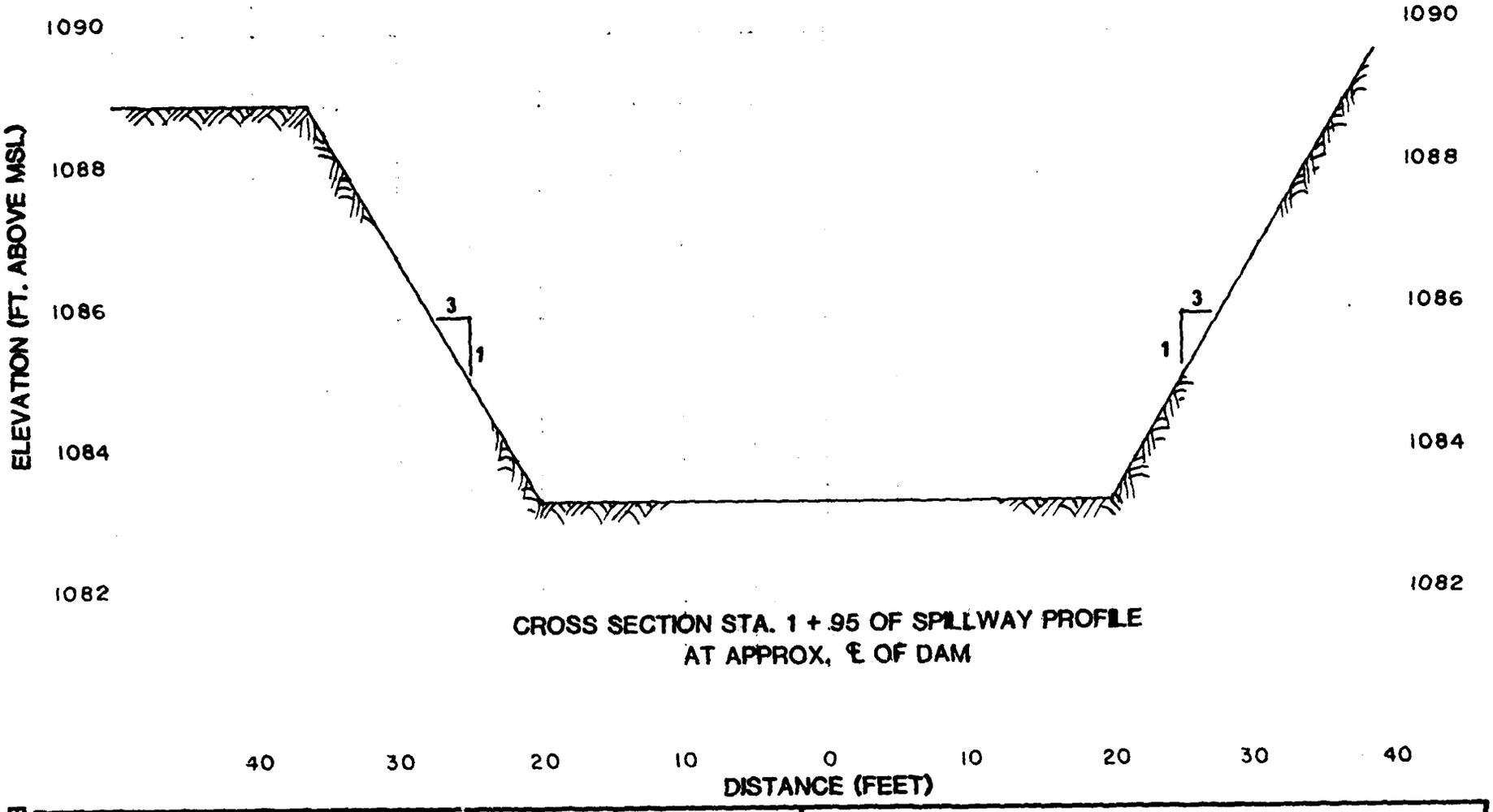


EXHIBIT 4

CRAWFORD, MURPHY & TILLY, Inc. Consulting Engineers SPRINGFIELD, IL • LINCOLN, IL • AURORA, IL	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	EMERGENCY SPILLWAY FLOWLINE PROFILE LOST CK. WATERSHED STRUC. D-1 MO20731



CROSS SECTION STA. 1 + 95 OF SPILLWAY PROFILE
AT APPROX. ℄ OF DAM

EXHIBIT 5

CRAWFORD, MURPHY & TILLY, Inc. Consulting Engineers SPRINGFIELD, IL • LINCOLN, IL • AURORA, IL	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	SPILLWAY CROSS SECTION LOST CK. WATERSHED STRUC. D-1 MO20731

```
A1 HYDROLOGIC/HYDRAULIC ANALYSIS - LOST CREEK WATERSHED STRUCTURE D-1 (MO20731)
A2 NATIONAL DAM SAFETY PROGRAM -- CORPS OF ENGINEERS, ST. LOUIS DISTRICT
A3 CM&T JOB NO. 8034-02                FEBRUARY 18, 1981
B    240       0      12       0       0       0       0       0      -2       0
B1     5
J      1       9       1
J1  0.16    0.17    0.31    0.32    0.33    0.34    0.35    0.50     1.0
K      0  INFLOW                                          1
K1 INFLOW HYDROGRAPH COMPUTATION
M      1       2    1.63                       1                               1
P      0    27.5     102     120     130     140
T                                                      -1     -88              0.04
W2          0.54
X      0    -0.1       2
K      1    LAKE                                       1
K1 RESERVOIR ROUTING BY MODIFIED PULS METHOD
Y                                      1       1
Y1     1                                                -1065.5      -1
Y41065.5  1066.0  1066.5    1067    1068    1070    1074    1078    1082  1083.4
Y41084.4  1085.4  1086.4  1087.4  1088.4  1089.4  1090.4
Y5     0    13.2    37.2    39.9    41.6    44.9    50.7    55.9    60.6    62.2
Y5   117     291     595    1043    1595    2292    3080
$S     0      16    56.6     107     200     343   473.2     515     755     820
$E  1054    1060    1066    1070    1075    1080  1083.9    1085    1090    1091
$$1065.5
$D1088.8     2.6     1.5     745
$L     0     230     750     795
$V1088.8    1089  1089.2    1090
K     99
```

EXHIBIT 6

CRAWFORD MURPHY & TILLY, Inc. Consulting Engineers SPRINGFIELD, IL • LINCOLN, IL • AURORA, IL	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	HEC-1 INPUT DATA LOST CREEK WATERSHED STRUCTURE D-1 MO20731

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 6

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
2.	2.	3.	3.	3.	4.	4.	4.	5.	5.
6.	9.	13.	18.	22.	26.	30.	34.	39.	42.
46.	51.	57.	62.	67.	72.	82.	122.	192.	236.
226.	187.	148.	125.	112.	103.	95.	88.	82.	79.
73.	61.	45.	30.	23.	22.	20.	19.	17.	16.
15.	14.	13.	12.	12.	11.	10.	9.	9.	8.
8.	7.	7.	7.	7.	7.	7.	7.	7.	7.
9.	17.	29.	40.	48.	52.	54.	56.	57.	58.
58.	59.	59.	59.	59.	59.	59.	59.	60.	60.
60.	60.	60.	60.	60.	60.	60.	60.	60.	61.
71.	106.	156.	201.	232.	250.	262.	269.	274.	277.
279.	281.	282.	283.	284.	284.	285.	285.	285.	286.
286.	287.	287.	287.	288.	288.	288.	288.	289.	289.
322.	437.	599.	746.	846.	913.	981.	1049.	1104.	1141.
1177.	1239.	1317.	1385.	1431.	1476.	1631.	2276.	3407.	4070.
3836.	3114.	2432.	2023.	1776.	1611.	1472.	1349.	1254.	1193.
1108.	919.	669.	452.	388.	362.	338.	315.	294.	275.
256.	239.	223.	208.	194.	181.	169.	158.	147.	137.
128.	119.	111.	104.	98.	98.	98.	98.	98.	98.

STATION LAKE, PLAN 1, RATIO 6

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
2.	2.	3.	4.	5.	6.	7.	9.	11.	12.
14.	16.	19.	21.	24.	27.	30.	34.	38.	39.
40.	40.	41.	41.	41.	41.	41.	41.	42.	42.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
41.	41.	41.	41.	41.	41.	41.	41.	41.	41.
41.	41.	41.	41.	40.	40.	40.	40.	40.	40.
40.	40.	40.	40.	40.	40.	40.	40.	40.	40.
40.	40.	40.	40.	40.	40.	40.	40.	40.	41.
41.	41.	41.	41.	41.	41.	41.	41.	41.	41.
41.	41.	41.	42.	42.	42.	43.	43.	44.	44.
45.	45.	45.	46.	46.	46.	47.	47.	47.	48.
48.	48.	49.	49.	49.	49.	50.	50.	50.	51.
51.	51.	52.	52.	53.	54.	54.	55.	56.	56.
57.	58.	59.	60.	60.	61.	62.	99.	253.	573.
1048.	1470.	1720.	1829.	1843.	1811.	1753.	1680.	1599.	1533.
1467.	1388.	1285.	1159.	1033.	939.	855.	779.	711.	650.
595.	560.	528.	497.	467.	439.	413.	388.	365.	343.
322.	302.	287.	276.	266.	256.	247.	238.	230.	223.

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
NATIONAL DAM SAFETY PROGRAM

INFLOW & OUTFLOW, 34% PMF
LOST CREEK WATERSHED
STRUCTURE D-1 MO20731

EXHIBIT 7

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 8

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
3.	3.	4.	4.	5.	5.	6.	6.	7.	7.
9.	13.	20.	27.	33.	38.	44.	51.	57.	62.
68.	75.	84.	92.	98.	105.	121.	179.	282.	347.
333.	275.	218.	184.	164.	151.	139.	129.	121.	115.
108.	90.	66.	44.	34.	32.	30.	28.	26.	24.
22.	21.	19.	18.	17.	16.	15.	14.	13.	12.
11.	10.	10.	10.	10.	10.	10.	10.	10.	10.
13.	26.	43.	59.	70.	76.	80.	82.	84.	85.
86.	86.	86.	87.	87.	87.	87.	87.	88.	88.
88.	88.	88.	88.	88.	89.	89.	89.	89.	89.
104.	156.	229.	296.	342.	368.	385.	396.	403.	407.
410.	413.	414.	416.	417.	418.	418.	419.	420.	420.
421.	421.	422.	422.	423.	423.	424.	424.	424.	425.
474.	642.	881.	1097.	1244.	1342.	1443.	1543.	1624.	1677.
1730.	1822.	1937.	2037.	2104.	2171.	2399.	3347.	5010.	5985.
5642.	4580.	3576.	2976.	2612.	2369.	2165.	1984.	1844.	1754.
1630.	1352.	985.	665.	571.	533.	497.	464.	433.	404.
377.	351.	328.	306.	285.	266.	249.	232.	216.	202.
188.	176.	164.	153.	144.	144.	144.	144.	144.	144.

STATION LAKE, PLAN 1, RATIO 8

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	3.	3.
3.	4.	4.	5.	7.	9.	11.	13.	16.	18.
21.	24.	28.	31.	35.	37.	38.	39.	40.	41.
41.	42.	42.	43.	43.	43.	43.	44.	44.	44.
44.	44.	44.	44.	44.	44.	44.	44.	44.	44.
44.	44.	44.	44.	44.	44.	44.	44.	44.	44.
43.	43.	43.	43.	43.	43.	43.	43.	43.	43.
43.	43.	43.	43.	43.	43.	43.	43.	43.	43.
43.	43.	43.	44.	44.	44.	44.	44.	44.	44.
44.	44.	44.	44.	45.	45.	45.	45.	45.	45.
45.	45.	45.	46.	46.	46.	47.	47.	48.	48.
49.	49.	50.	50.	50.	51.	51.	52.	52.	52.
53.	53.	53.	54.	54.	54.	54.	55.	55.	55.
55.	56.	56.	57.	58.	59.	59.	60.	61.	62.
92.	162.	274.	433.	596.	817.	1027.	1344.	1892.	3886.
5405.	5194.	4299.	3500.	2991.	2662.	2428.	2248.	2113.	2014.
1932.	1835.	1692.	1523.	1366.	1225.	1102.	1002.	923.	851.
785.	725.	669.	619.	579.	549.	520.	492.	466.	440.
416.	393.	370.	349.	329.	311.	294.	284.	276.	268.

CMET	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	INFLOW & OUTFLOW, 50% PMF LOST CREEK WATERSHED STRUCTURE D-1 MO20731

EXHIBIT 8

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 9

0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	4.	5.
6.	7.	8.	9.	10.	11.	12.	13.	14.	14.
18.	26.	40.	53.	65.	76.	88.	101.	114.	124.
135.	150.	167.	183.	197.	210.	242.	359.	565.	694.
666.	549.	436.	368.	328.	302.	279.	258.	241.	231.
216.	180.	131.	89.	68.	63.	59.	55.	51.	48.
45.	42.	39.	36.	34.	32.	30.	28.	26.	24.
22.	21.	20.	20.	20.	20.	20.	20.	20.	20.
27.	51.	87.	118.	140.	152.	160.	165.	168.	170.
171.	172.	173.	173.	174.	174.	175.	175.	175.	175.
176.	176.	176.	176.	177.	177.	177.	177.	178.	178.
208.	312.	459.	592.	683.	737.	771.	792.	806.	815.
821.	826.	829.	832.	834.	835.	837.	838.	840.	841.
842.	843.	844.	845.	846.	847.	847.	848.	849.	849.
948.	1285.	1763.	2195.	2488.	2685.	2885.	3085.	3247.	3355.
3461.	3644.	3874.	4074.	4209.	4343.	4798.	6693.	10020.	11970.
11284.	9160.	7153.	5951.	5223.	4738.	4331.	3968.	3688.	3507.
3260.	2704.	1969.	1331.	1142.	1065.	994.	928.	865.	807.
753.	703.	656.	612.	571.	533.	497.	464.	433.	404.
377.	351.	328.	306.	289.	289.	289.	289.	289.	289.

STATION LAKE, PLAN 1, RATIO 9

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	2.	2.	2.	2.	2.	2.
2.	2.	3.	3.	3.	4.	4.	5.	5.	6.
6.	7.	9.	11.	14.	18.	22.	26.	31.	36.
38.	39.	39.	40.	40.	41.	41.	42.	43.	44.
45.	46.	46.	47.	47.	48.	48.	48.	48.	49.
49.	49.	49.	49.	49.	49.	49.	49.	49.	49.
49.	49.	49.	49.	49.	49.	49.	49.	49.	49.
49.	49.	49.	49.	49.	49.	49.	49.	49.	49.
49.	49.	49.	49.	49.	49.	49.	49.	50.	50.
50.	50.	50.	50.	51.	51.	51.	51.	51.	51.
51.	52.	52.	52.	52.	52.	52.	52.	52.	52.
53.	53.	53.	53.	54.	54.	55.	55.	56.	56.
57.	57.	58.	58.	59.	59.	60.	60.	61.	61.
62.	62.	75.	95.	112.	156.	206.	247.	282.	331.
388.	460.	566.	756.	983.	1248.	1515.	1811.	2176.	2794.
3218.	3462.	3686.	3909.	4093.	4239.	4509.	5467.	7689.	10447.
11476.	10384.	8506.	6936.	5904.	5227.	4685.	4245.	3913.	3669.
3454.	3112.	2600.	2124.	1882.	1716.	1574.	1467.	1368.	1276.
1190.	1110.	1036.	979.	923.	870.	819.	771.	725.	681.
639.	600.	572.	547.	522.	499.	478.	459.	442.	427.

CMT	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	INFLOW & OUTFLOW, 100% PMF LOST CREEK WATERSHED STRUCTURE D-1 MO20731

EXHIBIT 9

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .16	RATIO 2 .17	RATIO 3 .31	RATIO 4 .32	RATIO 5 .33	RATIO 6 .34	RATIO 7 .35	RATIO 8 .50	RATIO 9 1.00
HYDROGRAPH AT	INFLOW	1.63	1	1915.	2035.	3711.	3831.	3950.	4070.	4190.	5985.	11970.
		(4.22)	(	54.23)(	57.62)(	105.08)(	108.47)(	111.86)(	115.25)(	118.64)(	169.48)(	338.96)
ROUTED TO	LAKE	1.63	1	90.	128.	1450.	1566.	1702.	1843.	1991.	5405.	11476.
		(4.22)	(	2.55)(	3.63)(	41.07)(	44.35)(	48.20)(	52.20)(	56.37)(	153.06)(	324.95)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1065.50	1065.50	1088.80
STORAGE	53.	53.	697.
OUTFLOW	0.	0.	1874.

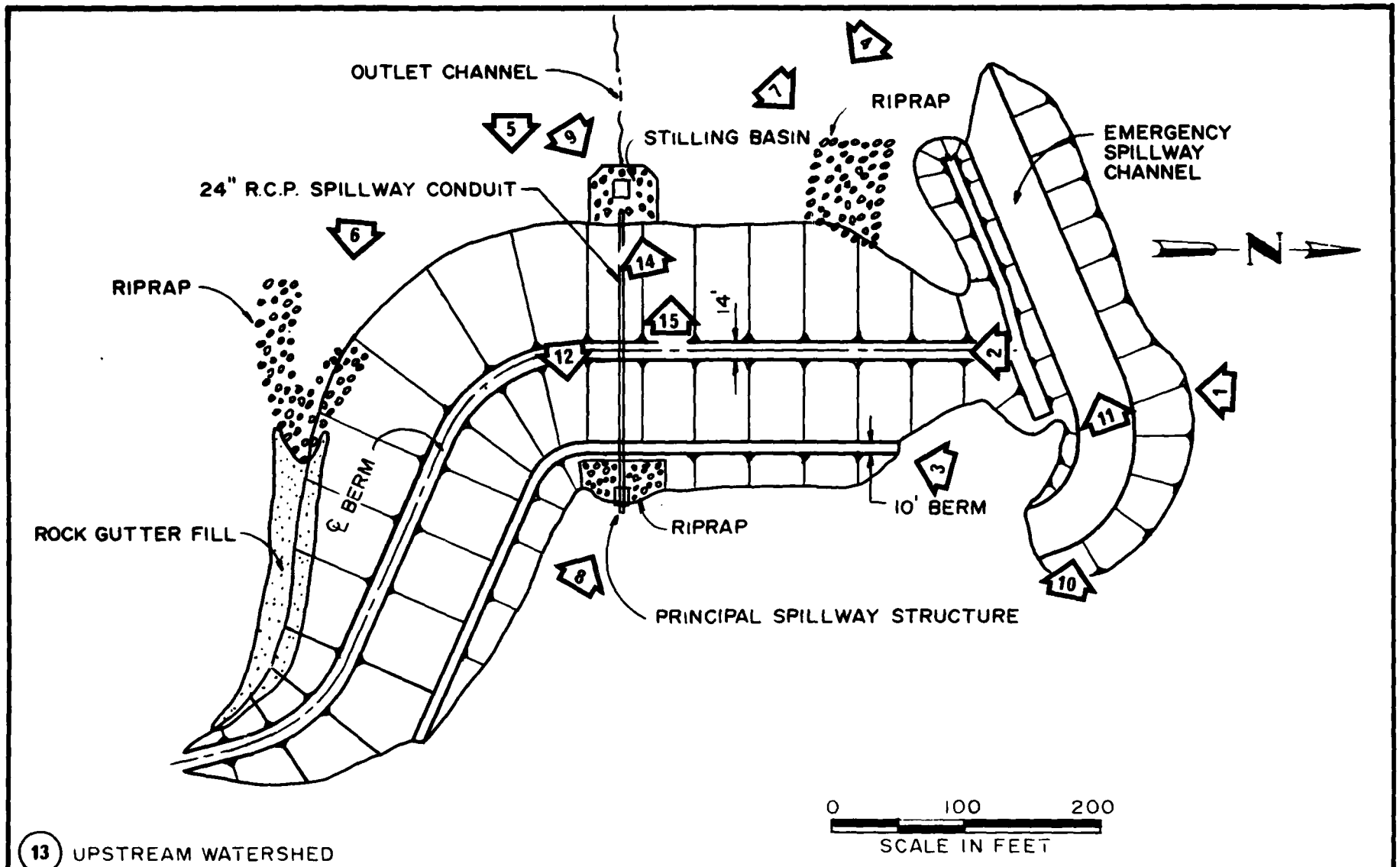
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.16	1083.91	0.00	473.	90.	0.00	45.00	0.00
.17	1084.46	0.00	495.	128.	0.00	44.20	0.00
.31	1088.14	0.00	666.	1450.	0.00	41.20	0.00
.32	1088.35	0.00	676.	1566.	0.00	41.20	0.00
.33	1088.55	0.00	686.	1702.	0.00	41.00	0.00
.34	1088.76	0.00	695.	1843.	0.00	41.00	0.00
.35	1088.95	.15	705.	1991.	.80	40.80	0.00
.50	1090.09	1.29	761.	5405.	2.60	40.20	0.00
1.00	1091.22	2.42	834.	11476.	5.40	40.20	0.00

EXHIBIT 10

PHASE I INSPECTION REPORT

APPENDIX C

PHOTOGRAPHS



CRAWFORD MURPHY & TILLY, inc. Consulting Engineers SPRINGFIELD, IL • LINCOLN, IL • AURORA, IL	U.S. ARMY ENGINEER DISTRICT, ST. LOUIS CORPS OF ENGINEERS NATIONAL DAM SAFETY PROGRAM	PHOTOGRAPHY INDEX LOST CREEK WATERSHED STRUCTURE D-1 MO20731

Photograph 2. Crest of dam viewed from right abutment.

Photograph 3. Upstream slope of dam viewed from right abutment.

Photograph 4. Downstream slope of dam viewed from outlet of emergency spillway channel near right dam abutment.

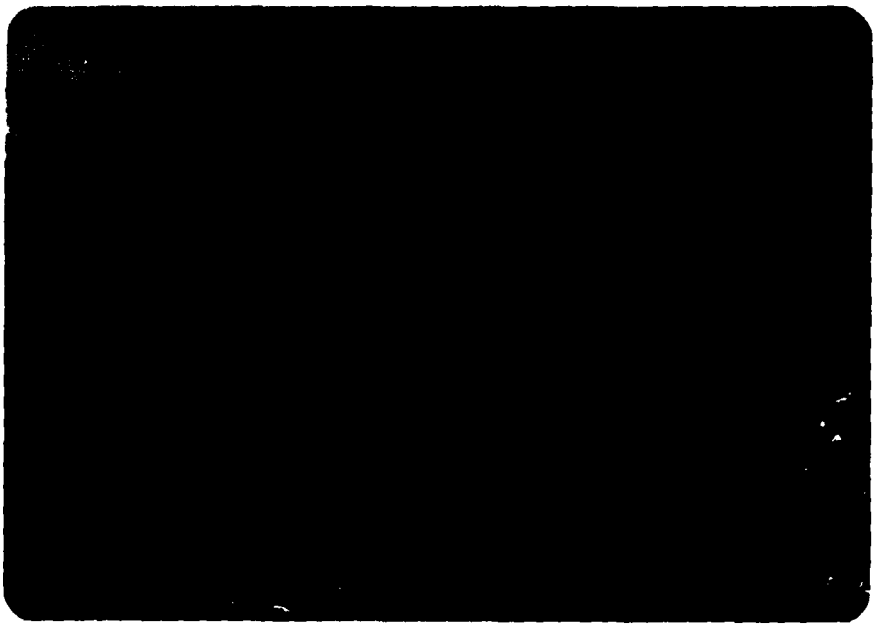
Photograph 5. Downstream slope of dam showing a close-up view of surface erosion.

Photograph 6. View showing rock rip-rap at base of left abutment on downstream slope.

Photograph 7. View showing rock rip-rap at base of right abutment on downstream slope.

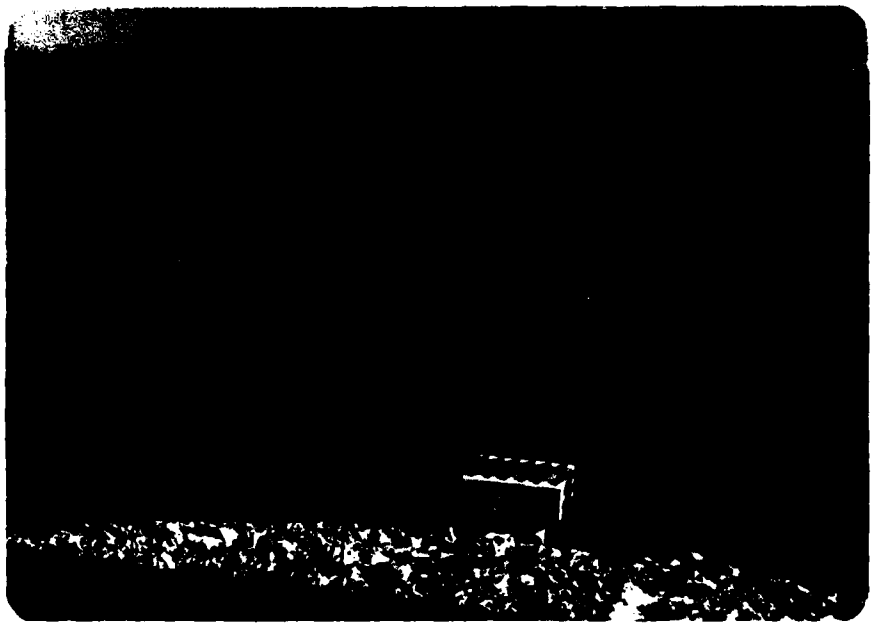
Photograph 8. Principal spillway inlet structure with rip-rap slope protection.

Photograph 9. Downstream end of principal spillway outlet conduit and rock lined plunge pool.

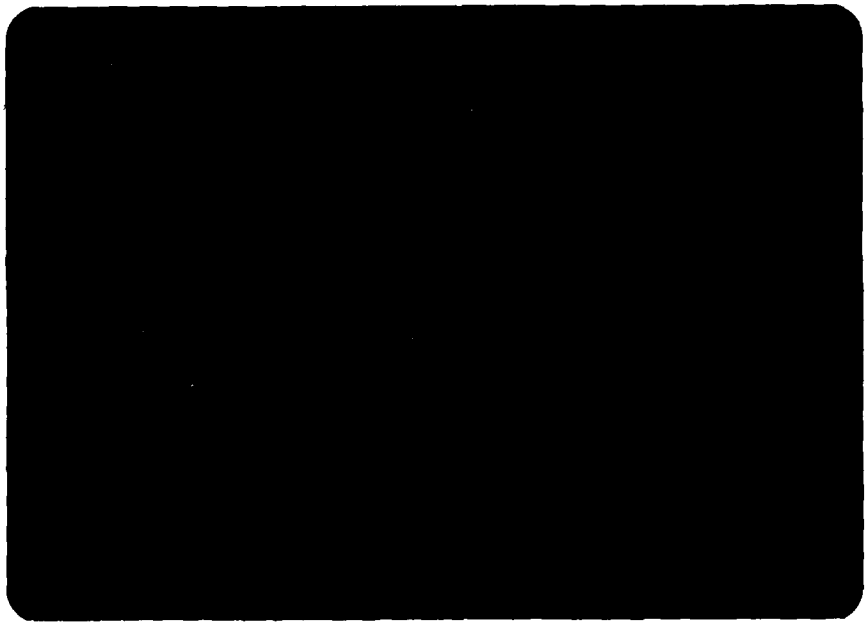


Photograph 10. View of crest of emergency spillway looking downstream from approach channel.

Photograph 11. View of emergency spillway discharge channel looking downstream.

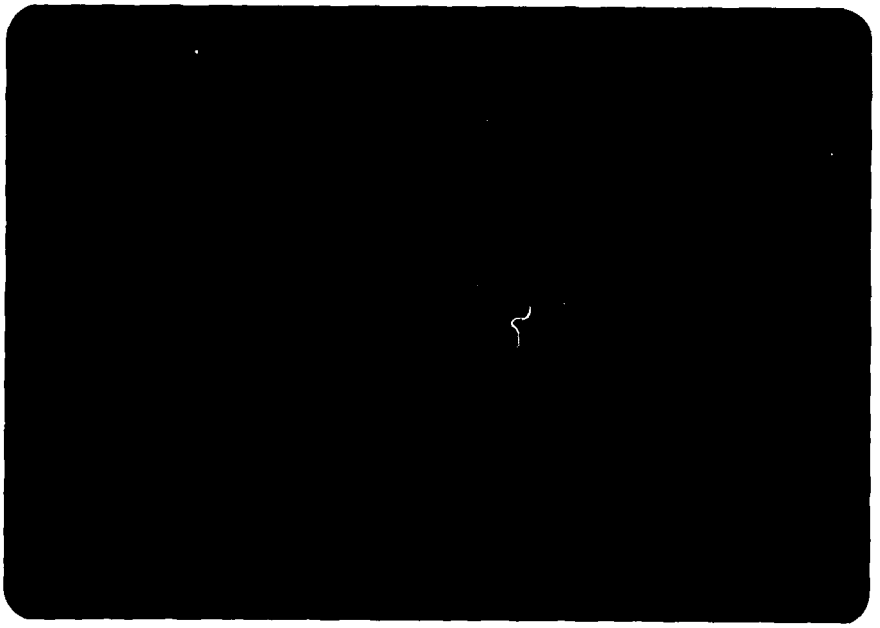


Photograph 12. Reservoir area and borrow pit area as viewed from crest of dam.

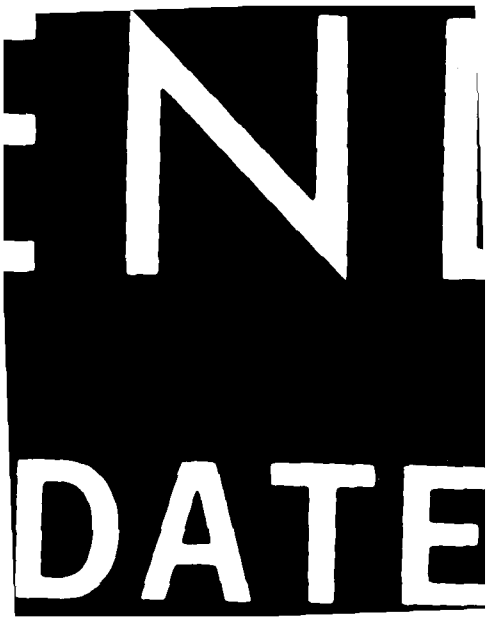


Photograph 13. Typical view of watershed area showing mostly open fields. Missouri Route 60 is in the background.

Photograph 14. View of downstream channel immediately downstream of plunge pool.



Photograph 15. Downstream flood plain as viewed from crest of dam.


N
DATE